**Strategy for increasing adoption of on-farm technology to improve labour efficiency in the Western Australian (WA) sheep industry**

**Royalties for Regions**

**Sheep Industry Business Innovation (SIBI)**

Centre Operations and Research Infrastructure: New on-farm technology

(Activity 1.2)

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1. **Introduction**

Our sheep flock in WA is estimated to be 14 million sheep and lambs in July 2015. This includes 7.5 million breeding ewes of which 6.7 million were mated. Approximately 5350 farm businesses in WA included a sheep enterprise with an average flock size of 2700 sheep and according to the 2011 census, 17% of sheep farms had flocks containing over 4000 sheep and accounted for 50% of WA ewes (Pritchett, 2016).

The sheep flock in WA has steadily declined from 38 million in 1991 to the current situation. There has been little incentive for those currently in the industry to increase their involvement or for newcomers to be involved. However, with an increase in demand for red meat protein from Asia and the Middle East there is now a real incentive and opportunity for WA sheep producers to either expand their flock or enter the industry.

The decline in the rural population in many regional centres has reduced the ability of sheep producers to attract and retain farm labour (Thompson and Young, 2013). Moreover, on-farm labour has been identified as a key constraint in the expansion of the sheep flock in WA. Many farm businesses have increased their crop enterprise and the sheep enterprise tends to be a lower priority in labour management decisions. As mixed-enterprise producers have purchased the latest technology for their crop enterprise (e.g. auto-steer, yield mapping and variable rate technology), they should be open to the idea of purchasing new technology for their sheep enterprise. Data and information on how the technology can be integrated into their sheep enterprise is required to support their decision.

A key barrier to adoption of technology is cost. To begin with, running a sheep enterprise requires a heavy investment into capital expenditure (e.g. fencing, laneways, sheep yards and shearing shed). Improvements in use of technology will push up capital expenditure requirements. A reduction in the need for labour may offset the higher capital investment, but the offset may not be sufficient to promote the necessary investment (Clear Horizon Consulting, 2016). Additionally, overall farm productivity can improve with the better use of existing technologies if they allow in increase in economies of scale (Kingwell *et al*. 2013). Thus, an increase in adoption of labour saving technology will need to be supported by data on the value in terms of saving labour costs and an ability to increase scale.

The key ‘levels’ of change that this activity will need to influence include:

* Change in awareness (knowledge)
* Change in understanding and skills (persuasion and decision)
* Change in practice/behaviour (implementation)

Supporting information including the value of the investment in terms of labour saved and increase in efficiency will be an important component of achieving a change in understanding and skills. After implementation, there should be a confirmation that the change was for the better and a shift in becoming an advocate for the technology and influencing others to change. Some specific tasks in this activity have been incorporated into the adoption process to show where they fit (Figure 1).

Field days

Forums

On-farm demos

Case studies

Benefit-cost analysis

Independent reviews (e.g. Kondinin Group

Communication & support

Decision

Implementation

Confirmation

Knowledge

Persuasion

Start here

Priority focus

Result = Adoption

Figure 1: Adoption process outlining tasks within the new on-farm technology activity

Clear Horizon Consulting (2016) have compiled a report outlining the barriers impacting on the growth of sheep production in WA. Both the high technology/capital costs and access to labour issues were identified as barriers. In light of these barriers the report specifically recommends:

* Identify opportunities for improved sheep management through better use of existing technologies and identify and promote opportunities for leasing or share arrangements for equipment and facilities that optimise the benefits while reducing high capital outlays
* Support the testing, development and transfer of new technologies that reduce the labour required in the seasonal peaks and increase sheep management efficiencies
1. **Situation analysis**

A survey of WA sheep producers with more than 500 sheep commissioned by DAFWA in 2011 revealed that the most popular labour saving devices were electronic weigh crate (53% of respondents), crutching cradle (51% of respondents) and lick feeders (46% of respondents). However, the percentage of respondents using other devices including automated jetting races, sheep handlers, auto-drafters and electronic identification (EID) eartags was low (all < 20%) (Curnow *et al.,* 2011). Additional questions were asked when the survey was repeated in 2014. The first question was about the use of walk-over-weighing (2%) and the second was about the use of Pedigree Matchmaker to determine dam pedigree in ewe/lamb flocks (1%) (Jones and Curnow, 2015).

Use of EID eartags is a key technology being promoted by the new on-farm technology activity. It allows individual management rather than mob-based managed so superior sheep can be identified and selected and consequently improve production. Further, it allows more efficient data entry/analysis and adoption of additional devices such as walk-over-weighing (WOW) or Pedigree Matchmaker (PMM). In the 2011 survey, only 4% of respondents were using EID but 20% of respondents were considering EID (Curnow *et al.* 2011). Similarly in the 2014 survey 4% of respondents were using EID but 16% were considering EID (Jones and Curnow, 2015). The interest in EID has been sparked by the Victorian government bringing in mandatory EID from 1 January, 2017. There are opportunities to support the increase in adoption of EID in WA through providing data on costs and benefits to a sheep enterprise from a productivity point of view and additionally through the enhanced biosecurity and traceability benefits.

There are some farm businesses in WA that have adopted many labour saving devices in their sheep enterprises and are further explored by Thompson and Young (2013). Bio-economic modelling was used to identify the importance of specific management and genetic interventions to improve labour efficiency and determine the impact on profitability. Constraints on the supply of labour had a significant impact on stocking rate, farm profit and the crop: sheep enterprise mix. Overall, it was found that improving efficiency of sheep husbandry tasks in isolation generally had little or no impact on farm profit. However, if labour efficiency was improved for multiple tasks through the year, or there was adoption of a package of changes to the livestock enterprise, then this would lead to large increases in profit (Thompson and Young, 2013). One specific example given in the report was a case study on David and Lyn Slade in Mt Barker. They were able to increase their whole farm profit through implementing a package of changes to improve labour efficiency throughout the year incorporating fencing, feeding grain, feeding hay, mustering and livestock handling (Thompson and Young, 2013). Thus, whilst we can support the adoption of stand-alone devices or systems to improve labour efficiency, there will be little impact on farm profitability unless they are part of a whole suite of interventions to the enterprise.

1. **Objectives**

Within the DAFWA strategic plan, there is a goal to double by value of the WA sheep industry by 2025. The new on-farm technology activity fits within this goal through growing productivity, growing profitability and growing people. First, adoption of technology will aid in productivity growth of farm businesses with sheep through an improvement of labour efficiency and an increase in the size of individual flocks. Second, adoption of technology will improve profitability through the ability to collect and use objective data to identify and retain genetically superior sheep. Furthermore, use of labour-saving devices can reduce the need to source reliable labour and reduce the cost of production. Third, adoption of technology will require the skill development of sheep producers and those higher up in the supply chain. As technology becomes more widely adopted there will be a grower need for skill development of stock agents and processors with the introduction of technology such as electronic National Vendor Declaration (NVD) forms and carcase tracking. The use of technology in the sheep industry will appeal to younger farmers who may have been drawn away from sheep previously by the lure of technology in the cropping industry. Thus, younger farmers are an important focus within this activity.

The objectives of this activity are to:

* Develop a value proposition, including a cost-benefit analysis for the integration of at least 5 existing and emerging technologies into a sheep enterprise to improve labour efficiency
* Measure the change in work practices of the members of a pilot group of producers over the period of the project as an indicator for the level of adoption
* Incorporate specific questions on adoption of new technologies into the next survey of WA sheep producers scheduled as part of the overall SIB I project

This activity aims to achieve a minimum of 10% of WA producers who are using EID by 2018. Further, we aim to achieve a minimum of 40% of WA producers who are considering adopting EID into their sheep enterprises. Additionally, we aim for a minimum of 50% of WA producers to be using some of the labour-saving devices mentioned in the 2011 sheep survey including the automated jetting race and sheep handlers.

***Milestone***

*Develop and submit a detailed extension/adoption strategy outlining specific activity beyond the pilot group of participants and specific adoption targets reflecting the project investment.*

This document outlines the strategy to meet the milestone above.

1. **Target audiences**

To increase the adoption of new on-farm technology by WA sheep producers we need to convince sheep producers of the value of the technology and motivate them to use it. The value will include a financial component in terms of a benefit-cost ratio and payback period to recover costs. There is also a benefit to improving occupational health and safety standards, reducing the physical labour required to perform husbandry tasks and improving animal welfare through improved and more regular monitoring.

This activity aims to present a set of well-documented, integrated, modern and technological solutions for sheep enterprises to improve decision making and reduce the cost of labour. Young farmers are a key target due to the relatively high age of sheep producers. In particular, we will provide opportunities for participation in events, study tours and demonstrations by members of AgConnect. This is the young farmer and agribusiness professional division of WA Farmers. They already have a strong, established network that we can use to share and distribute new knowledge.

The target audience of the new technology activity is as follows:

* Producers who have capacity to increase sheep numbers in their enterprise
	+ Incoming generation (< 35 year olds)
	+ Current generation (>35 year olds)
* Producers who currently have no sheep in their farm business and may be attracted back into them
	+ Incoming generation (<35 year olds)
	+ Current generation (35+ year olds)
* Specialist consultants who provide advice to sheep producers
* Forward thinking livestock agents who are a respected source of information on sheep

There is a lot of practical knowledge amongst experienced sheep producers about gaining efficiency through good design of capital items such as laneways, sheep yards and shearing sheds. It is hoped that producers who will be enticed back into sheep can benefit from this practical experience and this activity will seek opportunities to share design efficiencies.

1. **Specific activity beyond the pilot group**

***5.1 EID report and workshops***

DAFWA is currently putting on a consultant to write a report analysing the opportunities for individual sheep management in WA. This report will examine the latest thinking around the use of EID and the value it can offer sheep producers in WA to increase profitability, traceability and efficiency of the sheep enterprise. Further, the report may also be used as a foundation report in building an appreciation of the impact at an industry level. This report will cover current uses, limitations, future opportunities, a benefit-cost analysis for each opportunity and a summary of the skills, services and infrastructure needed for WA producers.

The outcomes of the report can also be integrated into workshops for producers covering EID. There is emerging interest in EID amongst producers about the value it can bring to their sheep enterprise. The new on-farm technology activity will work with industry consultants to help deliver practical workshops that can provide useful and timely information to producers as well as the outcomes of a benefit-cost analysis to support any decision making.

***5.2 Demonstrations at Katanning Research Facility***

An integral part of the new on-farm technology activity is transforming the Katanning Research Facility (KRF) in to a state-of-the art facility incorporating the latest technology in terms of remote monitoring, EID and sheep handling. As this is a facility that hosts multiple sheep trials, there is already EID equipment in place. We have built on what is currently there by also adding remote monitoring of tanks and troughs, Pedigree Matchmaker for determining ewe pedigree, walk-over-weighing and additional sheep handlers. Our aim is to showcase the technology at the KRF and how it can be integrated into a sheep enterprise with supporting economic information at regular industry forums and field days. We are also exploring opportunities to open up the KRF to further input from grower groups in doing sheep research and examining how technology can improve labour efficiency.

***5.3 Case Studies***

A central focus within the new on-farm technology activity is developing practical case studies on how a specific device or system has improved labour efficiency, with a supporting benefit-cost analysis. We have commissioned an economic consultant to interview the farmer and capture the costs, savings and other ongoing costs such as maintenance. Key figures that will be presented include the benefit-cost ratio (BCR) to obtain the dollar return (or cost saving) for every $1 invested. Further, the analysis will provide a payback period allowing other farmers to see how quickly the initial investment is recovered. The analysis is done over a period of time relevant to the specific technology and the returns are discounted back to present dollars.

We have produced case studies on remote cameras to externally monitor water troughs, a laneway system, an automated jetting race, using pedigree matchmaker to determine ewe pedigree and use of a sheep handler. Future case studies will be on EID, further investigation into sheep handlers and how an on-farm WIFI network can increase efficiency as more devices require internet and farms become more connected.

Outcomes of the case study will be written up in a short technical report and available on the DAFWA website.

***5.4 Media***

We plan to employ a freelance journalist to write a feature article suitable for the rural press on each of the case studies. This will include commentary from the producer about the value of the specific device or system has brought to their business. We will put out media releases about the key outcomes of each case study and any interested media outlets will be sent the feature article. Additionally, we will develop audio files as podcasts featuring the verbal interview with the farmer for downloading off the DAFWA website.

Each of the case studies will also be developed into a 3 – 4 minute film suitable for the DAFWA Youtube channel. This will be available on the DAFWA website and will feature the producer speaking about the device and how it has improved labour efficiency. Some economic information will also be included and interested viewers will be directed to the DAFWA website to explore further.

***5.5 Supporting existing extension programs***

We will seek out and identify opportunities to value-add and collaborate with existing extension programs within WA. One of these programs which has a focus on labour efficiency is The Sheep’s Back. This is a sheep network in WA made up of over 1000 people interested in the sheep and wool industry. There are regular seminars and field days held regionally where the current and timely information is provided to sheep producers. Additionally, they host an annual ‘Sheep Easy’ field day which features a panel session of farmers who run an efficient sheep operation with low labour input.

***5.6 Supporting grower groups***

There are grower groups in WA who have members interested in increasing their sheep numbers. We plan to support these groups by providing access to case study material or inviting them to be involved in a case study. Several grower groups have informed us that the use of technology to improve efficiency is a topic many of their members are interested in. As well as supporting their field days by providing speakers on technology we will provide resources to assist in any demonstrations the members of the grower groups want to do within their own sheep enterprise.

***5.7 Supporting consultants***

Many mixed enterprise producers use the services of a consultant. This has allowed many producers to successfully grow their business by obtaining specialized advice and timely information to support their decision making. As consultants play a key role in the decision making of sheep producers, we will provide them with access to our case studies and other relevant information to pass on to their clients. This will allow them to see the economic benefits of technology and help adapt the technology to suit the needs of their clients.

***5.8 Industry study tour***

There are sheep producers outside of WA who have already successfully integrated EID into their sheep enterprise. In 2016, we organised a study tour to regional NSW to attend the Lambex conference and to visit producers who had incorporated technology such as EID into their sheep enterprise. Victoria has now passed legislation to make it mandatory for sheep to have an EID eartag from 1 January 2017. This presents a unique opportunity to explore the adoption of EID and to observe the key issues faced by participants along the sheep supply chain. We aim to organise a study tour to regional Victoria in 2017 to explore how EID has been accepted by the sheep industry and to bring back any learnings to WA.

1. **Specific adoption targets reflecting the project investment**

In the 2011 survey of WA sheep producers, some questions were asked to determine efficiency based on a range of labour-saving devices outlined in Table 1. The use was highly variable and reflected a mix of the perceived value of the device, the time the device had been in the market place, the ease of integration into the farm operation and the cost. Electronic weigh crates, crutching cradles and lick feeders already had the highest ownership, with approximately 50% of respondents owning these devices (Table 1).

Around 20% of respondents indicated in the 2011 survey they were considering one or more of lick feeders, EID tags and auto-drafters, indicating this is where the growth would occur. We believe that through the data supplied to interested sheep producers on how the devices can be integrated into the sheep enterprise, adoption of these devices will improve. Our target adoption for EID is 10% of survey respondents by 2018, as more sheep producers see the value in using EID to identify and retain profitable sheep. Further, our target adoption for auto-drafters is 20% of survey respondents with more sheep producers understanding their value in differential management of sheep for optimum productivity and welfare outcomes. We would expect other capital items such as sheep handlers and automatic jetting races to be adopted by at least 50% of survey respondents as these are featured in our case studies (Table 1).

Table 1: Proportion of respondents from a 2011 survey and 2014 survey who use one or more labour-saving devices. Additional data included on targeted adoption rates in 2018 for the labour-saving devices. Note, only the auto-drafter and EID eartags were included in the questions in the 2014 survey.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **2011 survey (%)** | **2014 survey (%)**  | **2018 adoption target (%)**  |
| Electronic weigh crate | 53 | - | 75 |
| Crutching cradle | 51 | - | 75 |
| Lick feeder | 46 | - | 50 |
| Automatic jetting race | 17 | - | 50 |
| Sheep handler | 17 | - | 50 |
| Auto-drafter | 6 | 8 | 20 |
| EID eartags | 4 | 4 | 10 |

Sources: Curnow *et al.* 2011; Jones and Curnow, 2015 (2011 and 2014 survey data)

In the 2014 survey of sheep producers, the proportion of respondents actually using either walk-over-weighing (WOW) or Pedigree matchmaker (PMM) were very low (Table 2). Whilst there are benefits of WOW in remotely capturing liveweights, there are costs associated with training the sheep, the infrastructure required and the data analysis and interpretation. Thus, WOW technology may only suit specialized feedlotters who need to continually track growth rates of individual sheep. Many producers may opt to capture static weights through integrated sheep handlers with load bars fitted whilst performing other jobs such as pre-lambing vaccination or weaning. Use of integrated handlers is highly labour-efficient by preventing mustering and drafting where more than one job can be combined at once. Thus we expect only a modest increase in adoption and have set a target of 5% by 2018 (Table 2).

Similarly, we have set a modest target of 5% for the adoption of PMM (Table 2). This is a proven labour-saving technology for studs by determining ewe pedigree with reasonable accuracy through ewe – lamb combinations that walk past a fixed EID reader. However, there is other technology such as DNA analysis, where full parentage can be obtained for around $17 per sample. There is also research currently taking place in the new on-farm technology activity into using sensors on ewes and lambs which are applied after marking. These have Bluetooth technology and are programmed as either beacons or receivers and record ‘hits’ when a ewe and her lambs are within 1m proximity. Early trial work suggests full ewe – lamb pedigree can be obtained after 24 hours. Once this technology becomes proven and less cost – prohibitive it may be a more viable option than PMM.

Table 2: Proportion of respondents from a 2014 survey and targeted adoption rates in 2018 for sheep producers who are using either walk-over-weighing (WOW) or Pedigree Matchmaker (PMM).

|  |  |  |
| --- | --- | --- |
|  | **2014 survey (%)** | **2018 adoption target** |
| Walk-over-weighing system | 2 | 5 |
| Pedigree Matchmaker | 1 | 5 |

Source: Jones and Curnow, 2015 (2014 survey data)

1. **Monitoring and evaluation**

As technology becomes less cost prohibitive, there will continue to be new systems and devices that enter the market that will have labour saving benefits. For example, whilst PMM is currently a viable option to obtain ewe pedigree, there may be proximity sensors contained in an eartag that can be purchased and applied to ewes and lambs in the future to obtain ewe pedigree. Or the cost of DNA may reduce to the extent that it comes viable on a large scale. Thus, it can be a challenge to evaluate the uptake and adoption of specific labour – saving devices as new devices come onto the market.

We initially aim to measure the change in work practices for each member of the pilot group to determine if they integrate a new system or device into their sheep enterprise, as an indicator of broader adoption. The pilot group members are a good representation of sheep producers who already run large sheep enterprises, are open to technology and could be convinced to increase their sheep enterprise if the economics are there.

In order to capture the level of adoption in the broader community of sheep producers, we will include questions on the use or consideration of various labour-saving devices in the 2018 DAFWA survey of sheep producers. This will allow us to determine if we have met the adoption targets outlined above.

Additionally, the broader SIBI project will be running Sheep field days at the KRF as well as other industry forums and field days. We will use this opportunity to display and discuss labour-saving technology. Supporting information from our case studies will also be made available, as well as presentations from sheep producers who have successfully integrated technology such as EID into their sheep enterprise. As part of the general evaluation of the day, we will include specific questions about the level of interest in technology. Further, we will use the opportunity to ask questions about which devices have been adopted and making a positive difference to labour-efficiency.

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