

Completion Report for BSAS Scholarships

Name and affiliation:

Erica Schelfhorst, University of Melbourne, Australia

Award Name and value of the award:

Alan Robertson 2015 £700

Was any additional funding secured to support the activity?

(If yes, please state the value and source of funding):

\$200 AUD from the University of Melbourne, Faculty of Veterinary and Agricultural Sciences, Research Support

Start/end date of the award:

July 2016

Summary of the award (Briefly describe the objectives and how was it undertaken):

(approximately 300 words)

Objectives

Attend the 12th European International Farming Systems Association Symposium being held at the Harper Adams University, Shrewsbury July 2016 and present on my PhD research.

An abstract submitted to IFSA (Jan 2016) was accepted. A full paper was then written for workshop 1.1 Generating spaces for innovation in agricultural and rural development. This was subject to a blind peer review for editing purposes. A 10 minute powerpoint presentation was delivered at IFSA. This was well attended with over 30 people present followed by a 5min question and answer session.

An opportunity arose to enroll in an PhD intensive postgraduate course offered by IFSA and Harper Adams to be run in conjunction with the IFSA symposium for Masters and PhD students. The course ran over 6 days (IFSA 3 days) and was accredited for postgraduates with the Postgraduate Credit Scheme Associate.

Visit Edinburgh, Scotland to

- Meet with a current PhD candidate using AIS to understand co-learning and co-innovation to achieve impact in research.
- Meet with an academic that specialises in Innovation research in the Agricultural field.
- An additional visit was made to Kirkton Hill & Mountain Research Centre to discuss upland livestock and sheep electronic identification.

- Request was made for me to present my research to the Computational Genetics Discussion Group at the Roslin Institute. A 30 min presentation was delivered to approx. 15-25 people followed by a question and answer session.

Benefits of the Award:

This is the main part of the report and the two sections below should be approximately 1000 words in total. You may focus on benefits to yourself, to the animal science community, or both – depending on the nature of the activity undertaken.

Benefit of the award to you (e.g. new knowledge or skills, new contacts and collaborations):

This scholarship paid for me to attend the IFSA symposium held in July 2016 at Harper Adams University, UK. It also partly funded a study tour undertaken in Edinburgh and I took the opportunity to enrol in a PhD intensive course in Systems design thinking that was run concurrently to the IFSA symposium.

My PhD research skills and knowledge has been enhanced and enriched through being able to attend and participate in IFSA, the PhD intensive course and the study tour.

IFSA

Participation in IFSA has improved my academic writing and presenting skills. An abstract submitted to IFSA was accepted and hence a paper (up to 6000 words) and consequent presentation was provided. I chose to write a paper for workshop 1.1 Generating spaces for innovation in agricultural and rural development. The paper was blind peer reviewed and consequent editing was required before resubmission. A 10min presentation was provided at the symposium that was well attended with over 30 people present followed by question time. Furthermore two of my PhD supervisors were present at the talk who were then able to provide feedback.

The IFSA symposium has given me a broader understanding of agricultural systems research being undertaken around the world. The ability to talk to people in person after a presentation, to learn from them and clarify points of interest is a rewarding experience that I could only get by attending in person. The symposium also provided the opportunity to review certain aspects of my own research with nearly formed acquaintances.

PhD intensive course

The purpose of the intensive course was for PhD students to learn and engage with new ways of systems thinking and learn how these could be implemented in agricultural systems and potentially our own research. Systems thinking was the main theme for the IFSA symposium. Furthermore it allowed students to network and learn from each other and support each other throughout the IFSA symposium. A number of class, group and independent activities were undertaken during the course that helped to

facilitate my understanding and build skills in systems thinking. The PhD intensive was offered as an accredited course in which I enrolled, undertook the mandatory course requirements and consequently was recognised by the university as having passed. Some of the skills learnt from this course have helped to strengthen some aspects of my PhD research one of which is creating stronger boundaries around the different areas of investigation.

Study tour

The study tour was a networking opportunity. It enabled me to meet with people within similar fields of research and extension that I was able to learn from and bring back to Australia. A highlight was the opportunity to meet in person one of the academics whose Agricultural Innovation Systems framework I'm drawing from to inform my research.

Overall

This trip provided a unique opportunity to network, create new contacts and learn from scholars and like-minded peers, some of whom I had only known as authors on research papers. Now that I have met some of these people in person it has given me the confidence to approach them via email, to ask further questions about their research and share some of my research with them.

Benefit of the award to the animal science community, academic and industrial:

Share research ideas

The ability to be able to travel to another country and present my research and ideas has resulted in email requests to share my presentation and research information with people in similar fields in other parts of the world. My research ideas and findings resonate with others looking to get genetic advances into use by producers within the same industry and others.

Network opportunities

The face to face networking with many international scholars facilitates better communication channels and opens up the possibility of sharing work, ideas and enables potential future collaborations. It also creates an understanding of whom to approach, whom is the expert in a particular field, to guide or provide expertise to future research projects.

New ideas

Some of the research presented at IFSA has the potential to be applied within Australian farming systems. By learning from others, I have brought back to Australia some key skills and knowledge that is being integrated into an existing extension program to enhance the programs evaluation approaches. Furthermore some of the new skills learnt have been incorporated into my PhD research (boundary setting from systems thinking) and into my everyday job as a sheep extension officer (participant observation skills as described by a scholar from IFSA).

Other supporting information:

Please find attached presentation given at IFSA, the submitted IFSA paper and PhD intensive course result

Social and technical influences that enable and constrain adoption of genetic improvement by commercial lamb producers.

Erica Schelfhorst¹, Ruth Nettle¹, Barbara King¹ and Roger Wilkinson²

¹ The University of Melbourne, Victoria, eschelfhorst@student.unimelb.edu.au

² Department Economic Development, Jobs, Transport and Resources, Warrnambool, Victoria

Abstract

Productivity is important for improving the long term profitability and competitiveness of commercial lamb producers and the Australian lamb industry. Productivity can be achieved in part through improved genetics and as such it is considered a key profit driver for sheep producers. Yet improved genetics, such as breeding value technologies are still not completely accepted or adopted and the uptake of this technology is seen to be slower compared to other animal industries. The value of genetic improvement to productivity and profit has been repeatedly proven and demonstrated in scientific studies and yet the question that is still not well understood or investigated is why some commercial producers do not see and acknowledge the potential benefits. With genetic technology rapidly expanding, becoming more sophisticated and possibly more complex, there is now a greater need to recognize how producers make sense of breeding values and how social influences impact upon behaviour and beliefs or the meaning given to actions. Drawing on qualitative social research methodology and an agricultural innovation systems framework this study will explore the organisational roles and interactions of supply chain actors to address the following question 'How do social and technical arrangements within the Victorian lamb industry support or hinder adoption of genetic improvement by commercial lamb producers? Data collection and preliminary analysis to inform the research started in 2015. A number of focus groups with commercial lamb producers and semi structured interviews with industry representatives form the basis of early learnings around actor roles, beliefs, confidence, knowledge exchange and interactions.

Keywords: Agricultural innovation systems, breeding values, confidence, interactions, knowledge exchange

1 Introduction

The intended focus of this paper is to explore the interaction, knowledge exchange and presence of enabling situations between farmers and intermediaries that lead to innovation within the Victorian lamb industry in the state of Victoria Australia.

Research attention and a greater understanding of the roles that innovation brokers and facilitators perform in agricultural innovation is an area that requires further exploration (Klerkx & Leeuwis, 2009). These groups of either individual actors or organisations embedded within networks fulfil vital roles in relation to innovation processes as they facilitate access to knowledge, new technologies, provide interpretation and help overcome information gaps. They are seen to act as a bridge between the science providers who generate and supply knowledge and those actors who convert codified knowledge into practice such as farmers.

In Australia the role and function of advisory services that perform in the intermediary space are of increasing interest as the role it is slowly being removed from state funded extension providers into the hands of the private sector. For example the Victorian lamb industry is an extensive and diverse farming system that has traditionally been serviced by a high level of state government funded public advisors. With reduced state investment, there has been a noticeable increase in the engagement of

private intermediary roles to facilitate knowledge exchange, form new networks and accelerate innovation. The impacts of this change and the nature of intermediaries with regards to innovation processes has however received limited study and requires further examination, particularly in the Australian context.

Information pertaining to the role and function of intermediaries within this paper is informed from the wider research focus investigating the 'Social and technical influences that enable and constrain adoption of genetic improvement by commercial lamb producers, in the state of Victoria Australia'. The Agricultural Innovation Systems (AIS) framework is being used to help guide a comprehensive and systematic approach to explore the organisational roles and interactions of supply chain actors in new, innovative and holistic ways that has not been undertaken in Australian lamb industry.

The data and discussion presented are based on in-depth interviews carried out with a wide range of actors embedded in the lamb supply chain. Section 2 outlines the background and industry context that gave rise to the research study and questions. This is followed by the conceptual framework being used to guide the study. Section 3 describes the methodology. Section 4 summarises preliminary findings from the study while section 5 considers the key findings emerging from the data around the presence of enabling situations between farmers and intermediaries that lead to innovation within the Victorian lamb industry.

2 Background

Breeding decisions are important complex management decisions made within a farming enterprise. They influence future flock performance and farm profitability and as (Kaine & Niall, 2003, p. 2) reported are 'too important to be left to chance or whim'. It is an important complex management decision that should be better understood according to (Rowe, 2010) as the choice of sire made for every joining has a large and permanent impact on production and profitability that compounds over generations.

Research completed in the Australian wool and dairy sectors currently provide the most insights into how Australian livestock producers make breeding decisions and perceive genetic improvement, in particular the value of breeding value technology within their farming systems. The information while valuable cannot be fully extrapolated across the Australian lamb industry however, as different breeding strategies and supply chain systems exist. Furthermore these studies tend to focus on the decision making processes of the end user or farmer. The role and function of intermediaries upon innovation processes within this context has received less attention and yet they play an important role facilitating access to information, technologies and networks that support more efficient, productive and profitable farming practices.

The following sections outline the industry context and conceptual framework in which the research is being undertaken.

2.1 Australian lamb industry overview

Victoria is Australia's largest lamb producing state accounting for 42 per cent of national lamb production (VDPI, 2010), making it a significant contributor to Australia's red meat industry which is valued around \$15.7 billion (Kroker, 2013). With new emerging markets, particularly in Asia and others in the developing world (Ridley, 2013) many future opportunities are foreseen for the lamb industry (Kroker, 2013; Sheep CRC; VDEPI, 2014).

Rowe (2010) argues that the future profitability of the lamb industry depends on producers attaining high rates of productivity gain and producing quality products valued by consumers, both of which can be achieved through improved genetic selection and 'best' management practices. Genetic improvement technologies play a key role in increasing the productivity, profitability and market competitiveness (Islam et al., 2013; Sheep CRC) of the Australian lamb industry have been

accessible now for many decades. However the uptake of genetic improvement innovations to assist with selective breeding has been relatively low compared to other animal industries such as the dairy, poultry and pig sectors (Islam et al., 2013). Both research and industry bodies in Australia advocate room for improvement (Rogan et al., 2011; Sheep CRC; Williams, 2010). With industry benefits to be made from the implementation of genetic improvement via the use of quantitative genetics, industry bodies undertook large collaborative Research, Development and Extension (RD&E) initiative in the late 1980s to make lamb a competitive marketable product both domestically and globally (Banks, 2012). The current industry focus is to identify barriers to the uptake of genetic technologies and overcome these through better communication, training and skills development strategies (Rogan et al., 2011) so as to achieve accelerated rates of genetic gain in those traits of economic importance for Australian sheep producers (AWI, 2013; Rogan et al., 2011).

Animal selection has played a key role in breeding better animals for generations. Today's farmers continue to selectively breed as animals are still capable of rapid improvement or modification due to genetic variation (Hayes et al., 2013). Animal selection traditionally occurs by 'eye', that is a visual inspection of the animal's body, health, pedigree and environment (Holloway et al., 2011; Islam et al., 2013). Over time, continuous selection for desirable traits generally leads to improvements in productivity and performance. Show ring success, that is exhibiting an animal to a judge, can also play a part in the selection process (Banks, 2012). However as Banks (2012, p. 54) points out, in the lamb sector at least 'the characteristics used in judging both live sheep and carcasses bore little or no direct relationship to profitable meat production'.

Scientific advances throughout the past quarter of a century however have provided an alternative way to breed animals for increased productivity, determining genetic merit (the genes responsible for productivity and passed onto progeny) with a calculated figure called estimated breeding values or EBVs.

Estimated breeding values (EBVs) are a numerical value that indicates how strong or weak the genes are for various economically important production traits, such as growth rate. The use of EBVs in breeding decisions has been shown to increase animal performance across a range of species (Islam et al., 2013) and has had a positive impact in the Australian sheep industry generally acknowledged by science and industry (Barnett, 2006).

LAMBPLAN launched in 1989 is the Australian national system for describing genetic merit of animals in the sheep industry (Banks, 1990; Williams, 2010). LAMBPLAN works to genetically improve the 'terminal' and 'maternal' sheep breeds that operate under the sheep meat banner. Terminal breeds produce lambs that go directly to slaughter, while maternal breeds are used to breed the next terminal lamb.

Since the introduction of LAMBPLAN there has been significant, albeit variable, genetic progress across the major breeds in the Australian sheep industry (Barnett, 2006; Swan et al., 2009).

Breeding programs that implemented EBV selection produced by LAMBPLAN are credited with increasing the size of slaughter lambs and their carcass¹ weight (EDGE *network*, 2003). Banks (2012) reports that between 1993 and 2006 carcass weight increased sixteen percent from 17.64 kilograms to 20.53 kilograms while fat content decreased.

LAMBPLAN research, information and tools around breeding value technologies, better known as Australian sheep breeding values (ASBVs) has commonly been disseminated over the years through the development of extension programs and delivered through public and private providers. The adoption and utilisation of research however is dependent on the perceived benefits being accepted and adopted by the end-user (Corner-Thomas et al., 2013). Extension programs such as

¹ The body of slaughtered lamb minus the skin, head, hooves and internal organs

EDGENetwork², Making More from Sheep³ and the recent RamSelect⁴ workshops promote and encourage ram breeders and commercial sheep producers to adopt genetic improvement technologies to assist with the selection of rams that will breed the best progeny for them with 'more wool', or 'more meat' or 'more lambs' through buying in the right set of genes for production, quality and disease resistance. Furthermore network programs such as BestWool BestLamb⁵ run by the Agriculture Victoria (Victoria, Australia) are used by research organisations as conduits to transfer and diffuse knowledge about breeding value technology and the benefits of adoption throughout its farmer and group network.

Genetic improvement technologies, specifically breeding values, are however still not universally accepted or adopted within the sheep industry, a message conveyed and shared by Australian and international research (Kaine et al., 2002; Morris & Holloway, 2014; Swan et al., 2009; Williams, 2010). The science nonetheless has been proven to work and repeatedly demonstrated in scientific studies and practical on-farm demonstrations (Morris & Holloway, 2014; Ramsey, 2012; Williams, 2010).

Other studies contribute insights into how livestock producers perceive genetic improvement. Yet few are in the Australian context and inform enquiry across the whole supply chain in a comprehensive, systematic way such as Agricultural innovation systems. The use of AIS permits a much richer view and diagnosis of enablers, influences and constraints across an innovation system and as such is being used to guide this research.

2.2 The conceptual framework: Agricultural innovation system

This research adopts the Agricultural Innovation Systems (AIS) framework as it provides a systematic and comprehensive framework to analyse and categorise technical and institutional constraints to innovation. This permits critical analysis of the broad perspective, encompassing the whole production system and institutional environments in which actors are embedded (Amankwah et al., 2012).

A key concept underpinning AIS is that it stimulates innovative developments. Systems often work imperfectly (Amankwah et al., 2012; Islam et al., 2013; Lamprinopoulou et al., 2014), presenting 'innovation system failures'. Structural and functional elements help identify transformational failures and merits (Klerkx et al., 2012). The failures become analytical focus points (Hekkert et al., 2007) which identify pathways for alignment and coordination (Wieczorek & Hekkert, 2012). Overall functionality of the entire innovation system may therefore be examined to determine if collective innovation priorities are being met, 'and if not, what prevents transformative change towards desirable direction' (Lamprinopoulou et al., 2014, p. 4).

The strength of AIS, recognised as such amongst researchers (Lamprinopoulou et al., 2014) is that it encompasses a holistic diagnostic view of an agricultural innovation that includes the individual adopter (commercial lamb producer), service providers (public and private agribusiness) and formal science stakeholders (Sheep CRC⁶, LAMBPLAN) (Amankwah et al., 2012). A whole systems approach to investigating genetic improvement within the lamb industry affords a richer analysis of technology adoption issues whereas analytical tools used in isolation only tell part of the story.

² EDGENetwork is a series of workshops that provides technical and business skills for sheep farmers

³ Making More From Sheep is a manual containing 11 sections on 'best practice' technical information for sheep health, pastures, breeding, business management, etc. Information signposting is also provided allowing producers to find further information.

⁴ RamSelect is a one day training course offered by the Sheep CRC designed to build sheep producers confidence around using breeding values for ram selection and purchase

⁵ Bestwool Bestlamb is a Victorian producer network program whereby likeminded sheep producers come together and with the help of a facilitator and establish self-directed learning.

⁶ Cooperative Research Centre for Sheep Industry Innovation, Australia

The purpose of AIS in the wider study is firstly to inform the lamb industry about its capacity and potential as a successful innovation system by identifying constraints and enablers across the supply chain and secondly to contribute to the literature on the operational performance of agricultural innovation systems for diagnosing, planning and intervening to improve innovation. Klerkx, Aarts, and Leeuwis (2010, p. 391) also suggests that the use of AIS can 'contribute to building blocks for adaptive agricultural innovation policies that can deal with the unpredictability of innovation processes'. The empirical application and analysis of a key Australian agriculture industry as an innovation system will furthermore contribute to AIS literature.

This paper however specifically explores the role, enabling environment and activities between farmers and intermediaries to elicit knowledge and a better understanding of the fit, role and operational performance of the intermediary that leads to innovation.

3 Methods

This paper provides a preliminary insight into the enabling environments that occur between farmers and intermediaries in the Victorian lamb industry, Australia. The data presented in this study is obtained from interviews with farmers, research and industry organisations who are involved with the use or non-use, diffusion, extension or development of genetic innovations.

The interview questions and analyses used to inform the discussion were structured according to a criteria based upon the agriculture innovation systems framework and social research methodology. This is being used to map and understand the interactions and organisation of the genetic improvement system.

Semi structured interviews were conducted over 2015 with fifteen ram breeders, breed society members, research and industry people involved in the extension, diffusion or development of genetic innovations including private consultants, livestock agents, sheep pregnancy scanner, public extension officers, processors and scientists. The key question for this cohort of the supply chain aims to address: 'How do value chain actors influence the benefits producers can attain from use of improved genetic animal selection information?'

Focus group interviews were conducted with over thirty like-minded commercial farmers that either use or did not use rams with breeding values. The groups were purposely split into separate focus groups so that the questions could be explored in some depth without opposing views being expressed during the interview. The key question under investigation includes 'How do different producer groups differ in their decision processes associated with animal selection and the use of quantitative assessment measures? With a specific focus being placed on attitudes and beliefs about quantitative assessment, the farm system context, market influences and advisory support'.

All interviews were audio recorded and subsequently transcribed. The software program NVIVO 11 was used to facilitate a thematic analysis of farmer and intermediary interviews.

In this paper the analysis was extended to provide further understanding on knowledge exchange, actor interactions, enabling environments and specific activities around the application of genetic technologies. The key question being addressed in this paper is 'to what extent is there a presence of enabling situations between farmers and intermediaries that lead to innovation within the Victorian lamb industry?'

4 Findings

Findings from the thematic analysis of farmer and intermediary interviews are presented as a set of responses to the key research interest in this paper around the roles of actors embedded within the system, enabling environments and specific activities that generate spaces for innovation.

4.1 The role of intermediaries in the Victorian sheep industry

Sheep farming in Australia is in general a pasture fed, extensive system sitting within a mixed farming enterprise. The majority of the farmers interviewed in this study ran up to three different enterprises on their farms: a lamb or red meat enterprise, a wool enterprise as a result of using merino⁷ ewes for lamb mothers and the third was generally a cropping (grain) enterprise.

Given the diverse nature of the enterprises run on these farms there are many actors who potentially act in intermediary roles in the Victorian sheep industry. This includes farmers, agribusiness, public and private extension providers, private sector stakeholders, processors and research organisations. Private sector actors include consultants (provide financial, general farm advice or specialist advice in disease, nutrition, breeding), agribusinesses (provide general farm supplies, chemicals, meat and wool agents, pregnancy scanners, shearers), vets and breed societies.

Within an innovation system actors are those that contribute to the development, diffusion and utilisation of a technology, product or service (Islam et al., 2012). In AIS actors are conceptualised under four broad areas namely, research, enterprise, intermediary and demand according to the actor's activities and roles in the innovation system. The research domain (universities, research institutes) produce basic or applied research and generate knowledge and is considered a supplier of knowledge. Actors on the demand side use innovative products and services (farmers, processors). In between the supply and demand domain are the intermediaries (public and private extension officers) who may not necessarily provide expert advice or be involved in knowledge creation or usage but facilitate knowledge flow and exchange by joining fragmented innovation system actors.

Intermediaries that participated in this research included:

Two public extension officers: State government funded employees who undertake project work and operate in the Bestwool Bestlamb network (state funded project run by Agriculture Victoria) facilitating self-directed farmer groups and delivering knowledge and information with an aim to enhance productivity, efficiency and profitability of farmers.

Four private consultants: Three are involved in the Bestwool Bestlamb network in addition to operating their own agricultural consultation business. The fourth operates independently and operates more often in the wool industry but was starting to service an increasing number of clients in the lamb industry.

Interviews conducted with the following group of actors, it could be argued fit in the supply (research) and demand (farmers) sectors of the AIS framework. Yet, information obtained from the actors below found that all have performed in an intermediary role when time and situation has created the space for this function. Furthermore it is recognised that an actor can move between roles (Islam et al., 2012; Lamprinopoulou et al., 2014).

Two science researchers who work in industry funded research and development corporations develop knowledge but also pilot and deliver extension knowledge and programs to farmers through existing networks. Both people have been involved in the development and delivery of a national projects designed to accelerate genetic improvement by ram breeders and commercial farmers.

Further interviews were undertaken with other highly networked actors embedded within the lamb industry including: two livestock agents, one pregnancy scanner, red meat processor and two breed society members who are also stud ram breeders.

⁷ A Merino is a specialist wool producing sheep that is the predominant ewe mother for lamb (red meat) production in Australia.

Early results suggest that there are two or three key relationships influencing farmer's decisions around ram buying criteria and the application of improved genetics such as Australian sheep breeding values.

The majority of participants considered livestock agents and ram breeders to highly influence farmer's use of genetic innovations. Livestock agents are part of a well-connected network of actors within the lamb system. They buy and sell sheep for clients and act as a conduit of information and knowledge on current market place requirements for farmers who employ their services. Livestock agents were used as a source of expertise to select and buy rams by some farmers as they had confidence and trust in their judgement. Interestingly the pregnancy scanner suggested that the livestock agents could also be used as a sounding board by farmers to reassure decision making processes, thus setting the scene for an enabling environment where innovation could occur.

"Agents are used by farmers as a confidence boost, they want a second opinion and they are the boost they need to select" (pregnancy scanner)

Livestock agents and other sheep industry service providers such as, pregnancy scanners and shearers based upon their role and capabilities are similarly aligned to farmers under the AIS conceptual framework whereby knowledge, innovative products and services tend to be demand driven and put into practise. Yet within the context of this research the livestock agents 'fit' was more aligned within the intermediary domain where it was observed that they facilitated knowledge flow between actors in the innovation system. It was noted that a number of the commercial farmers actively sought livestock agents out for advice and guidance about ram selection decisions as they were seen as experienced, knowledgeable and well networked individuals. The livestock agents are therefore not just facilitating information flow but are contributing knowledge that is influencing how farmers use genetic innovations.

4.2 Generating spaces for innovation

In this section the presence of enabling situations between farmers and the intermediaries as described above, that impacted or influenced the use of genetic innovations were explored.

To examine this area further, questions posed to intermediaries, such as; *'Describe how you help farmers to select their ram breeder / individual rams'* and *'Who do you think gives good advice to help farmers make choices about ram selection?'* were used to learn about knowledge exchange and to better understand the relationships between actors. Furthermore thematic coding along the lines of influences, participation in events, information source and selection practises generated findings around enabling environments or constraints seen within the genetic innovation system.

4.2.1 Enablers within the innovation system

Participation in an 'elite' group for one ram breeder provides the motivation and encouragement to undertake innovative processes. The ram breeder is a strong advocate for breeding values and uses them for animal selection within his flock. He is also a member of the national genetic scheme LAMBPLAN. Discussion with the farmer suggest that the environment in which he operates pushes him to be perhaps less risk adverse and more open to innovations and experimentation. Fellow group members collectively share and support the decision making processes especially when it comes to evaluating young sires (rams) that could be viewed as high risk breeding prospects as they tend to have less accurate breeding values. Group members undertake and share similar risks in their progression to accelerate genetic gain within their flock. In addition to his participation in an engaging environment this ram breeder is a firm believer in the uptake of new technology and it was a word that was reiterated throughout the interview, especially in the context of genetic innovations.

"Well its new technology and it has the potential to increase the value of our livestock" (ram breeder using breeding value technologies)

Genomic technologies to discover the genes for improved meat eating quality are currently being evaluated within his flock.

An interview with a different ram breeder told a similar story. He is embedded within a different breed based group that again share similar interests, goals and risks. This group can be seen to provide engaging environments where innovation processes are shared between people with similar interests in achieving genetic gain.

Both ram breeders are long term members of the national genetic scheme LAMBPLAN that provides a further innovative enabling environment. Findings however suggest that for one ram breeder this group is viewed in a very different light to that of the breed society. Participation in LAMBPLAN, for him, is used more for marketing purposes.

In relation to this work, the supportive breed groups seem to be providing the engaging environment in which both farmers operate and undertake innovations. In addition both farmers are highly networked individuals to many actors across the supply chain that are positive and encouraging of accelerating genetic gain within the industry.

4.2.2 Constraints within the innovation system

The following findings explore some of the likely constraints occurring within the innovation system.

“If you are not using Australian sheep breeding values you’re a bloody idiot” (science supplier)

The quote leans towards a source of disengagement and disconnect between the science suppliers and this particular ram breeder. This was found to be a shared experience with some other interviewees.

Livestock agents were frequently referred to as a cohort that inhibited the uptake of genetic innovations by intermediaries (private and public consultants, pregnancy scanner) and farmers whom are advocates of genetic technologies.

“Agents are notoriously low for using ASBVs and that. They need a bomb under them to get them to the right side if the ledger I think” (ram breeder using breeding value technologies)

In this sense livestock agents are viewed as gate keepers to the use of improved genetics by these actors. Livestock agents are highly valued by many of the farmers that participated in this research and for some agents are used to select and purchase rams on their behalf. The farmers trust and have confidence in the decision making processes of the livestock agent.

Agents as a trusted confidant of the farmer can reinforce the perception that breeding values do not provide value as suggested by this farmer which was recounted similarly by others.

“I think if it could be demonstrated that buying rams with figures improved your bottom line, as opposed to buying rams visually, I think that would be enough to make me want to do it” (commercial lamb producer)

Yet knowledge about the science which has been proven to work and repeatedly demonstrated in scientific and practical on-farm trials (section 2.1) has been disseminated to farmers since the formation of LAMBPLAN, over 20 years ago.

A further view point similarly shared by other intermediaries considered the farmer as the gatekeeper to any changes.

“There are more people using objective assessments, they are tending to move away from that subjective assessment of sheep, they are starting to understand the difference. But the ones that aren’t, I think there’s 2 things going on there, there too busy, don’t want to know or I’m too old, I’ve

done it this way forever, I'm making enough money, and I don't care. I think that's reality. There is a definite generational thing but also I'm too busy trying to keep my head above water to look up and see what's going wrong" (private consultant).

The norms about what is or is not a good ram was conveyed strongly by participants from all sectors of the supply chain.

"Size matters. A producer will not buy a small ram no matter what the Australian sheep breeding values say" (innovation broker)

This idea resonated strongly and was approved of when discussed with different groups of commercial farmers, despite close links with intermediaries or other enabling environments.

5 Discussion and Conclusion

This paper considers two areas of insight into the presence of enabling situations between farmers and intermediaries that impact on innovation within the Victorian lamb industry. Additional work is still to be undertaken to substantiate and provide further data around the following outcomes.

Ram breeders and livestock agents are key actors within the lamb industry who influence ram selection decisions. Livestock agents play an important role in the dissemination of knowledge, information and technologies to farmers. Their beliefs and knowledge, own life experiences and potential bias becomes a source of powerful messages and influences conveyed to some but not all farmers. Intermediaries, both public and private advisors, although engaged and part of the network were not seen to be as well utilised as the livestock agents as a source of knowledge. Yet, there are an increasing number of private consultants that are being sought out by science suppliers to support commercial farmers and ram breeders to accelerate genetic progress. This is thought to be achieved by helping farmers to select the right ram and placing them in the right situation for optimum production and economic output while meeting the desired breeding objectives of the farmer. If farmers are actively seeking advice from livestock agents about breeding and ram selection decisions however, then this cohort of actors need to be more actively engaged by the research sector so as a wider network of farmers can be reached and educated about objective genetic innovations.

Livestock agents in this study are viewed mostly as gate keepers to the use of improved genetics. They therefore act as a constraint to the acceleration of genetic gain, particularly to the level being sort by industry bodies to maintain domestic and export market competitiveness. Further research will define if there is a self-reinforcing community of practise emerging in this space. In particular we need to understand if the livestock agents are training the next generation of gate keepers. This in turn will lead to a greater understanding around the relationships formed with farmers and part they play in enabling or constraining the application of genetic innovations.

Other findings that relate to the wider study but could potentially provide further insight into the nature of relationships between farmers and intermediaries include the presence of norms about what is a good ram or breeder. There is a need to understand how strongly these beliefs are held, to what extent are they being reinforced and by whom. An unexpected finding was the lack of awareness of some farmers that they are purchasing rams from ram breeders who are embedded in the genetic scheme LAMBPLAN. Additional investigation is taking place to understand how this is possible and any potential implications.

With genetic technology rapidly expanding, becoming more sophisticated and possibly more complex, there is now a greater need to recognize how producers make sense of an innovation and how social influences impact upon behaviour and beliefs or the meaning given to actions (Nettle et al., 2010; Sneddon et al., 2009). In addition there is a recognised need to learn more about the intermediaries;

the nature of their relationships (Howells, 2006), their specific capabilities (Klerkx & Leeuwis, 2009) and for them to be operationally defined and well-evaluated (Koutsouris, 2014).

This study takes a step towards understanding some of the underlying social dynamics, influences and technical arrangements within the Victorian lamb industry. This includes defining the type of functions or roles, relationships and fit of intermediaries within the Victorian lamb industry to fully appreciate their impact on genetic innovation processes. In identifying constraints and enablers across the lamb supply chain the aim is to inform the industry about its capacity and potential as a successful innovation system.

6 References

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