Drivers for Innovation in the Poultry Industry

What are the barriers and drivers for adoption of innovative practices in the poultry industry?

A report for

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Executive Summary

Poultry meat consumption has rapidly increased since the 1960s. Innovation in shedding, management and genetics has seen great increases in daily gains and improved feed conversion resulting in cheaper more consistent product. The increase in consumption has led to the growth of both the number and size of farms.

Innovation drivers come in many forms. Drivers towards innovation can sometimes also act as barriers if not implemented and communicated correctly.

Some key factors that determine adoption of innovation include cashflow, regulation, industry and company structure, industry insight, disease outbreaks, media campaigns, urban sprawl and knowledge of innovative practices or products.

Innovation doesn't always mean increased profits or productivity. There is a distinction between consumer led innovation reducing productivity, and grower led innovation boosting productivity. Drivers for innovation can be divided into four categories:

1. Industry led;
2. Processor led;
3. Farmer led; and
4. Consumer led.

Regulations imposed by government, animal welfare agencies and industry bodies can act as both drivers and barriers of innovation. Well written insightful regulation can serve the industry well by driving it toward innovative practices and ideas. However, regulation that is based on consumer trends or traditional methods or standards can act as an inhibitor of innovation. Increasingly the minority is driving the industry toward change that is increasing the cost of production by influencing regulators.

The key to adoption on one farm maybe completely different to uptake on another farm. Many farmers are not aware of or are ignorant to problems on their own farms.

Creating awareness of new ideas is the beginning to encouraging innovation. Motivation though education creates possible solutions to these problems. Communication of what other farms in the area are doing or where industry trends are heading is a great way to encourage farmers to innovate.

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Foreword

My love for agriculture originated in the heart of the Hunter Valley on a 25-acre hobby farm where I grew up. As I grew older, my love for science, animals and the environment continued to grow. After completing High School, I continued my studies with a Bachelor of Rural Science at the University of New England in Armidale, New South Wales (NSW).

While studying I undertook many roles in the industry. I have been a cellar hand and a laboratory manager in wineries, worked at a produce store and have started my own poultry business specializing in backyard poultry, equipment and supplying heritage breeds to locals.

In 2014, I began working with Baiada Poultry as a poultry serviceperson. I provided technical advice to broiler chicken growers and learnt how the industry worked, how important factors such as ventilation and broiler integrity were, what they meant to the growers and the company. I gained experience in managing difficult situations and how to manage conflicts.

After two years working with broiler chickens, my role was changed to begin working with turkey broilers. As part of this role I have learnt the vast differences between turkeys and chickens. I have gained knowledge in different brood practices, challenges with older style housing and the effect of different management practices on the growth of turkeys.

Innovation seen in the industry is varied. Some farms are very innovative with shedding or management practices and ideas, while others seem as though they have not changed their practices since their original sheds where built.

With more shedding being erected each day, resources for bedding material, water, land and electricity are becoming scarce. Due to increased biosecurity risks, companies are now pushing for more thorough clean out procedures and are requiring single use litter. This means that once every 6-8 weeks all the litter must be replaced in every shed. That puts more pressure on an already shortened supply of bedding materials. I originally proposed a topic on investigating alternative bedding sources for poultry shedding.

Upon discussion with my investor Agri-Futures Australia, I found that there is already a vast array of alternate sources in Australia. However, these are not widely adopted. This was what has led to my current Nuffield topic of 'Why Not?' Why are some farms immaculate tunnel ventilated sheds with full automation while other sheds are still original shutter sided conventional sheds? What drives farmers to innovate? What are the barriers to adoption of these newer innovative technologies? Is there a way to get quicker uptake of the new technologies?

My Nuffield journey began with the Contemporary Scholars Conference (CSC) held in beautiful Brazil. From here I continued on the six-week 'Chile' Global Focus Program to discover a global perspective about agriculture.

I continued my personal studies by visiting Hybrid turkey facilities in Canada and touring with Cuddy Farms. From there, I travelled to the USA and attended conferences on poultry nutrition, animal welfare and biosecurity. I toured some hatcheries and poultry facilities with COBB representatives and met with an industry ventilation expert.

The final two weeks of my Nuffield research were spent in New Zealand talking to representatives from Poultry Industry Association New Zealand (PIANZ), Tegel Foods and Brinks. Here I got to see processing facilities, turkey operations and the daily operation of the livestock division.

Throughout my Nuffield travels I was constantly amazed at the hospitality of everyone I visited. I have grown immeasurably, both personally and professionally. I now have plenty of insight on my industry and many other industries that I would not have had without my scholarship.

Figure 1: The Author, Jessica Pitkin, at work in Australia

Acknowledgments

I would like to thank my husband for keeping life rolling in Australia while I travelled abroad.

I would also like to thank my kids for helping out and coping while I was away.

I would like to thank Nuffield and my investor AgriFutures Australia for giving me this opportunity. A special thank you to Kylie Hewson for her support throughout this journey.

Furthermore, the guidance and support from the Nuffield community was, and still remains outstanding.

I would also like to thank my employer, Baiada Poultry, for allowing me to have time off to travel and my co-workers for filling in.

I would also like to thank everyone who I stayed with and who helped me on this journey.

Abbreviations

ABARES: Australian Bureau of Agricultural Resource Economics and Sciences

ABF: Antibiotic Free

A: Avian Influenza

ACMF: Australian Chicken Meat Federation

CA: Canada

CSC: Contemporary Scholars Conference:

FAO: Food and Agricultural Organisation of the United Nations

FCR: Feed Conversion Ratio

GGP: Great Grand Parent

GP: Grand Parent

NSW: New South Wales

NZ: New Zealand

PIANZ: Poultry Industry Association New Zealand

RSPCA: Royal Society for the Prevention of Cruelty to Animals

USA: United States of America

WHO: World Health Organisation

Objectives

- Investigate national regulations imposed by governments, regulatory bodies and animal welfare agencies to determine the effect of litigation and external body standards.
- Compare and contrast different marketing systems to determine whether there is a difference in uptake of innovative practices e.g. quotas vs integrated companies.
- Investigate the effect of integrated companies and company structures on the adoption of modern sheds and practices.
- Investigate a range of characteristics possessed by growers though out the regions visited to determine if there is a particular trait that determines how innovative a grower may be.
- Identify trends in the poultry industry globally that are likely to affect Australia.

Chapter 1: Introduction

Poultry meat consumption has rapidly increased since the 1960s. Innovation in shedding, management and genetics has seen great increases in daily gains and improved feed conversion resulting in cheaper more consistent product. The increase in consumption has led to the growth of both the number and size of farms. Another effect of increasing demand has been the rise in dominance of the integrated company structure, similar to United States (USA) models.

Historically, the Australian poultry industry was widely spread and adopted mainly as a sideline income stream on family farms. The size of the sheds was often small, and farms consisted of one or two sheds.

The modern-day Australian poultry industry is characterised by several large companies that dominate the market. These companies are fully integrated and control great grandparent (GGP), grandparent (GP) parent stock, breeders, broilers, hatcheries, feed mills and processing plants. 80% of growers nationally, grow under contract for an integrated company (Poultry Hub, 2018).

Today, the poultry industry has changed greatly from the backyard operations of the past. Poultry farms are mostly standalone businesses with much larger tunnel sheds being constructed. Newly built farms generally consist of four or more sheds.

Contract growers are usually in a competitive contract that ranks farms from a particular region against each other. Farms that perform well are rewarded with additional income similar to a bonus scheme. If a farm performs poorly over a time period or batch average the farm may be deemed inefficient and can lose the contract to grow birds. It is thus important for a farm to remain competitive.

Although many of the older style sheds have now closed there are quite a few that remain in business with a range of shedding upgrades that have been implemented. Some are still well maintained and possess many of the features they were originally built with while others have been fully restored or rebuilt into modern more efficient shedding.

New sheds that are built today are a lot more automated however some farms build stock standard sheds with the basic requirements of the company they are contracted to, while others do vast amounts of research and adopt some of the latest cutting edge technologies that may or may not be proven technology in a hope their sheds run more effectively.

Sheds built today are still in the old-fashioned square shed style, with a roof and four walls. Why are sheds still square, why aren't they round? (Tegel Foods)

Google Dictionary defines 'Innovation' as a new method, idea or product and that innovation is crucial to the continuing success of any organisation. This leads to the question, if innovation

is crucial to success why isn't everyone innovating? Are there certain barriers that stop innovation? Are there particular things that drive innovation? Are there particular traits that innovators have that others do not? Is it possible to increase adoption of certain innovations?

Increasingly there is more litigation regarding how farmers can operate their businesses. Through government organisations, rules and regulations have been developed in animal health, welfare and biosecurity. Through these regulations' governments aim to maintain food safety and national biosecurity ensuring that strict protocols are adhered to. The regulations can act both as a driver for innovation and a barrier depending on how well researched and how outdated a particular standard may be.

The next level of control comes from the systems which each country uses. Canada still uses a quota system in which a farm buys quota and has a guaranteed sale for the birds. In this system the grower has control and choice of the inputs of each batch they grow. There is much debate to whether this style of business inhibits innovation. In this report the difference between growers under a quota system and non-quota systems will be investigated to determine whether there is an effect on adoption and innovation.

Large integrated companies are seen in many countries throughout the world. Integrated companies have the power to drive innovation through their contracts and internal rules and regulations. Integrated companies need to continue to improve food conversion ratio and average live weight while improving animal welfare and biosecurity practices in line with what supermarket and restaurant chains stipulate.

The poultry industry is forced to continually change their systems, inputs and outputs to meet the demands of the public often driven by animal welfare and activist campaigns. In recent years free range has become increasingly popular throughout the world. This has however led to many increased risks that companies are left to deal with. The free-range industry has been another driving force behind regulation and innovation in the industry.

The reduction of antibiotic use in agriculture is another force that is driving innovation in animal husbandry practices. Antibiotic free production of poultry is a challenge that much of the poultry industry globally are currently facing.

Modern poultry farms are run by a diverse range of farmers. Some farms are run as owner operated businesses while others are run under corporate structures that may own many farms and employ managers. There are also farms that are multi generation and others that are bought as a lifestyle farm. This report aims to investigate if a particular type of farmer trait or characteristic is more likely to drive or become a barrier to innovation on farm.

This report aims to identify trends and innovative practices in the poultry industry that may be able to be implemented.

Chapter 2: Industry Overview

Chicken is the second highest consumed meat globally; in 2015 poultry meat consumption was estimated at 13.8kg per capita (Table 1). Poultry consumption has grown dramatically since the 1960's, and this trend is illustrated in Figure 1 below. The Food and Agricultural Organisation of the United Nations (FAO) predicts by 2030 poultry will overtake pig meat as the top consumed product.

Table 3.10: Food consumption of meat							
	1964/66	1974/76	1984/86	1994/96	1997/99	2015	2030
	kg per capita, carcass weight equivalent						
World	**24.2**	**27.4**	**30.7**	**34.6**	**36.4**	**41.3**	**45.3**
Developing countries	10.2	11.4	15.5	22.7	25.5	31.6	36.7
excl. China	11	12.1	14.5	17.5	18.2	22.7	28
excl. China and Brazil	10.1	11	13.1	14.9	15.5	19.8	25.1
Sub-Saharan Africa	9.9	9.6	10.2	9.3	9.4	10.9	13.4
Near East/North Africa	11.9	13.8	20.4	19.7	21.2	28.6	35
Latin America and the Caribbean	31.7	35.6	39.7	50.1	53.8	65.3	76.6
excl. Brazil	34.1	37.5	39.6	42.4	45.4	56.4	67.7
South Asia	3.9	3.9	4.4	5.4	5.3	7.6	11.7
East Asia	8.7	10	16.9	31.7	37.7	50	58.5
excl. China	9.4	10.9	14.7	21.9	22.7	31	40.9
Industrial countries	61.5	73.5	80.7	86.2	88.2	95.7	100.1
Transition countries	42.5	60	65.8	50.5	46.2	53.8	60.7
Memo item							
World excl. China	28.5	32.6	34.3	34.1	34.2	36.9	40.3
World excl. China and transition countries	26.5	29	30.6	32.4	33	35.6	39.1
	Meat consumption by type (kg per capita, carcass weight equivalent)						
World							
Bovine meat	10	11	10.5	9.8	9.8	10.1	10.6
Ovine and caprine meat	1.8	1.6	1.7	1.8	1.8	2.1	2.4
Pig meat	9.1	10.2	12.1	13.7	14.6	15.3	15.1
excl. China	9.7	10.8	11.3	10.4	10.3	9.9	9.7
Poultry meat	3.2	4.6	6.4	9.3	10.2	13.8	17.2
Developing countries							
Bovine meat	4.2	4.3	4.8	5.7	6.1	7.1	8.1
Ovine and caprine meat	1.2	1.1	1.3	1.6	1.7	2	2.4
Pig meat	3.6	4.1	6.4	9.6	10.8	12	12.2
excl. China	2.1	2.4	2.8	3.3	3.4	4	4.7
Poultry meat	1.2	1.8	2.9	5.8	6.9	10.5	14
excl. China and Brazil	1.2	1.9	3.2	4.8	5.2	8.1	11.6

Table 1. Global Meat Consumption (FAO, 2018)

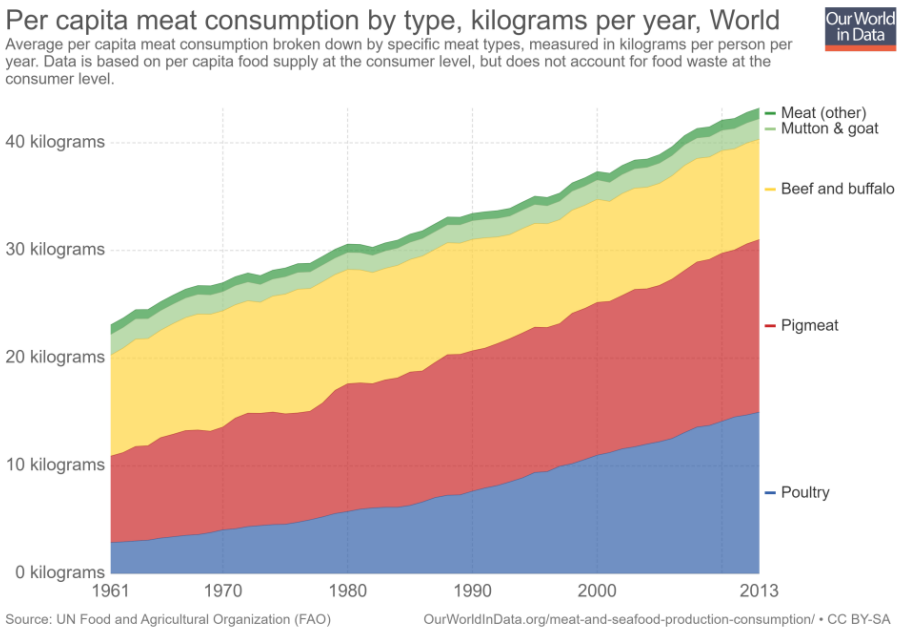

Figure 2.Trends in global meat consumption (Ritchie, H. Rosor, M. 2017)

Australia

95% of chicken processed in Australia is grown under contract and consumed domestically (Australian Chicken Meat Federation, ACMF, 2018). There are two major processors in Australia – Inghams and Baiada – who supply more than 70% of the market.

The Australian poultry industry has grown rapidly over the past 50 years. According to ACMF, poultry meat consumption in 1963 was 4.2 kg per person. This has grown to 49.3kg of chicken per person in 2016 (ABARES, 2017). In 2016, Australia produced 1.26 billion kilos of chicken predominantly for the domestic market. Chicken consumption is shown in Table 2 below.

Australian Government
Department of Agriculture and Water Resources
ABARES

Meat - pig and chicken

14.3 World pig and chicken meat production in selected countries

	2010	2011	2012	2013	2014	2015	2016
	kt (cw)	kt (cw)	kt (cw)	kt (cw)	kt (cw)	kt (cw)	kt (cw)
Pig meat							
Australia	339	344	352	360	362	374	386
Brazil	3,195	3,227	3,330	3,335	3,400	3,519	3,700
Canada	1,783	1,817	1,844	1,822	1,805	1,899	1,914
China **a**	50,712	50,604	53,427	54,930	56,710	54,870	52,990
European Union **b**	22,627	22,953	22,526	22,359	22,540	23,290	23,523
Russian Federation	1,981	2,064	2,175	2,400	2,510	2,615	11,121
United States	10,186	10,331	10,554	10,525	10,368	11,121	11,320
World	103,003	103,587	106,873	108,828	110,566	110,376	109,969
Chicken meat							
Australia	977	1,049	1,087	1,100	1,141	1,176	1,264
Brazil	12,312	12,863	12,645	12,308	12,692	13,146	12,910
Canada	1,023	1,027	1,038	1,052	1,074	1,112	1,150
China **a**	12,550	13,200	13,700	13,350	13,000	13,400	12,300
European Union **b**	9,202	9,490	9,660	10,050	10,450	10,810	11,533
India	2,650	2,900	3,160	3,450	3,725	3,900	4,200
Russian Federation	2,310	2,575	2,830	3,010	3,260	3,600	3,730
United States	16,563	16,694	16,621	16,976	17,306	17,971	18,261
World	78,078	81,138	83,267	84,399	86,555	88,694	89,098

a Excludes Hong Kong. **b** Regarded as 28 countries.
Sources: Australian Bureau of Statistics, *Livestock Products, Australia,* cat. no. 7215.0, Canberra; US Department of Agriculture, *Production, Supply and Distribution Database,* Washington DC

Table 2.Domestic Meat consumption in Australia (ABARES)

Canada

In 2016, Canada produced 1.15 billion kg of chicken from 2,817 regulated farms, the average farm produced 556,641kg of chicken. Canadians domestically consumed 35.2kg of chicken per person in 2016 (Agri-Food Canada).

The Canadian poultry industry operates under a supply management system, this system aims to control the supply though a marketing board. Products such as eggs, chicken and breeder stock are all under supply management.

United States of America (USA)

97% of poultry produced in the USA is grown under contract. Five large companies control more than 75% of USA poultry production. The five companies that produce the majority of chicken in order of size are Tyson Foods, Pilgrim's Pride, Perdue, Sanderson Farms and Koch Foods.

In 2015, the USA produced 17.97 billion kilograms of chicken (ABARES, 2017). In 2014, turkey meat consumption was 5.4kgs per person while chicken was 26.6kg per person (US International Trade Commission, 2014). Combined consumption of turkey and chicken meat in the USA was 32.3kg per person in 2014. Figure 2 shows the consumption trends of chicken over the period from 1970 to 2014 (USDA, 2016).

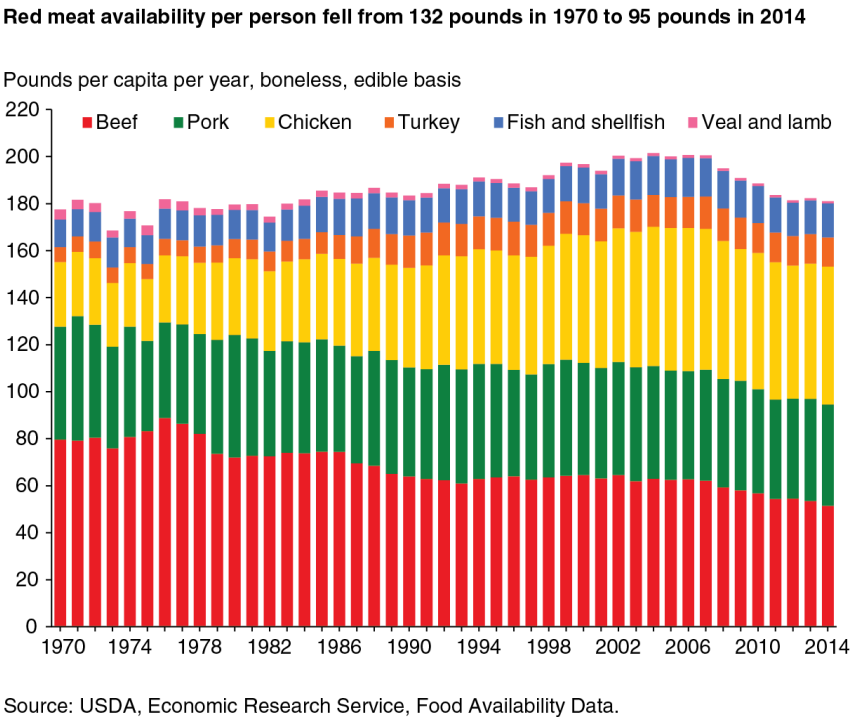

Figure 3.USA meat consumption 1970-2014 (USDA)

New Zealand (NZ)

The poultry industry in NZ has four main processors, Tegel Foods, Inghams, Brinks and Turks. The NZ poultry industry is unique in that national biosecurity is high, resulting in a very low disease status of NZ poultry. Poultry are able to convert feed very efficiently due to the lack of diseases that are fairly common in other countries. In 2016, poultry meat consumption was 38.4kg per person (Statista, 2018).

Chapter 3: Innovation

Innovation in the poultry industry

Innovation is a new method, product or idea. Since the beginning of the intensive poultry industry, there have been many innovations. Sheds were originally built out of timber and iron and lacked insulation, feeders were hoppers that the farmers had to fill by hand and drinkers were fonts that also had to be filled by hand.

Modern day poultry production has made the systems of the past unviable. Increased farm and shed size have forced innovation of systems such as automatic feeder and drinker lines. As the demand for chicken has continued to grow, stocking densities have increased creating a need for better ventilation. The requirement for better ventilation resulted in mechanical ventilation systems being implemented followed by fully automated tunnel ventilated sheds.

Innovations such as those mentioned above have led to increased productivity and often increased farm revenue.

The modern broiler industry seems to be moving more towards practices that are not directly correlated to increased farm productivity. Modern practices that increase the cost of production include free-range and RSPCA certification. Free range production has been growing steadily over the past decade and accounted for 15% of the market in 2010 (ACMF). Increasing demand for RSPCA certification has largely been driven by supermarkets and restaurant chains. The demand for more ethically raised birds has increased over the past decade resulting in more certification schemes and an increase in the cost of production.

Figure 4: The Author in a supermarket in Canada with Flamingo Turkey

Today's industry has greater focus on farm appearance, biosecurity, environmental effects and animal welfare than ever before. This focus is reflected in some of the innovations that are currently trending globally. Farms are moving towards free range production, natural lighting and sheds with windows, slower growing birds, traceability of birds, controlled atmosphere stunning, litter management and antibiotic free production.

Many of these innovations increase the cost of production and increase the amount of time that a farmer must spend on farm and in sheds without increasing their income. If the farmer cannot see a clear return on investment of either their time or money how does the industry continue to innovate and progress?

Drivers of innovation

There are many drivers for innovation, however some of these drivers may also act as barriers if not implemented or researched correctly.

In a report, ACMF quoted the Australian Farm Institute's view that: "*The agriculture sector needs to take responsibility for its own future directions by engaging in objective and credible policy research, rather than relying on government and policy-makers to come up with solutions*". However, it can be argued that rather than industry leading the way, increasingly, a vocal minority are making ground pushing their agendas through supermarkets and restaurant chains that do not want to make headlines so succumb to their demands. Some of these requirements have begun to make their way into policy and have increased to cost of production for many processors. This cost has been passed down to many farmers in the form of a pay cut from many integrated companies in early 2018.

Innovation doesn't always mean increased profits or productivity. There is a distinction between consumer led innovation reducing productivity and grower led innovation boosting productivity. Drivers for innovation come in many shapes and forms. The drivers for innovation can be divided into four categories:

5. Industry led;
6. Processor led;
7. Farmer led; and
8. Consumer led.

Each of these categories have different objectives and this is often reflected in the productivity and profitability on farm.

Industry Led

Industry leaders, research corporations and government have the power to shape industry in the long-term. Through research, policies and regulations industry led innovation aims to protect the industry and help ensure its longevity.

Governments set policies and procedures related to the larger issues of the industry such as biosecurity and animal welfare. It is imperative to the future of the poultry industry that

industry leaders have a say on government policy. Too often in agricultural industries minority parties are influencing policy makers and do not have the industries future in mind. Many of these parties want to cripple the industry and often stretch the truth to increase their influence as seen recently in the live export industry and with the production of the infamous 'Aussie Farms' map.

Governments may offer grants for innovations they find imperative to national security. A grant scheme is in place in Canada that pays for composting facilities for farmers. This decreases the risk of avian influenza and helps protect the industry on a national level. The Australian government has recently announced an environmental stewardship programme which aims to increase environmental protection for private land holders. New biosecurity regulations have funding for government to educate the industry to help provide awareness of what biosecurity means for small holdings and commercial ventures. This funding however does not provide an incentive for producers to implement more bio secure practices.

Industry bodies such as ACMF, and PIANZ work with processors, vets and the government to support the poultry industry. Industry bodies are funded by the industry for the industry. Industry bodies come up with national standards and guidelines that adequately address the concerns of both parties.

The Canadian Dairy Commission recognised a knowledge gap between traditional herringbone dairy farmers and modern rotary dairy farmers. They recognised that this knowledge gap was one of the limiting factors for the traditional style farms to be upgraded to the more innovative rotary dairies and implemented a mentoring program. Through this, farmers where paired up and could learn the ropes of newer systems without the risk of economic loss. Egg Farmers of Ontario (Canada) have a similar program that helps with entry into the expensive quota system. This program also helps farmers to acquire the knowledge required to set up and run a poultry farm. Programs such as these, help bridge a gap between connecting farms and sharing information which is an essential part of innovation.

Research and Development Corporation's such as Agrifutures Australia fund research to explore innovations that help ensure the future of the industry. These research corporations have boards who work in and around the industry that brainstorm ideas that they believe will benefit the overall future of the industry. Through this funding, scientists research the effectiveness of new technologies and communicate the pro and cons of implementing practices or technologies to industry leaders.

Disasters such as disease outbreaks act as a major driver for innovation and often highlight the need for increased regulation. In recent years, the increased number of cases of avian influenza has had a dramatic effect on many practices in the poultry industry. European farms have increased their biosecurity, no longer allowing vehicles to enter sheds. All trolleys that enter farms must travel through disinfection baths before being allowed onto farm or into a shed.

Through research it was recognised that avian influenza was found in wild birds and followed the pattern of migratory birds, this led to increased biosecurity practices globally. The avian influenza outbreaks led to improved biosecurity measures such as increasing water sanitation, all in all out operations (all birds come in a short period of time and are all removed before a new batch of birds arrive), shed boots and reduced traffic on farms to name a few.

Processor Led

Processors are great drivers for innovation as they generally have a level of control of farms through the use of contracts. Providing it is within the terms of the contract, processors can drive change in the industry quite effectively. Processors generally drive change that will increase a farms productivity and profitability. In recent years, processors have faced the challenges enforced on them from customers to improve animal welfare standards and implement additional authentication practices. Processors have implemented additional authentication systems in fear of being locked out of the supply chain.

Integrated companies such as Baiada and Inghams set their own standards in their contracts and management guidelines. These companies adhere to government policy while focusing on management practices that will maximise revenue. Larger integrated companies often have staff dedicated to overseeing farm managers and keeping farms up-to-date with requirements from government and the company, while maximising efficiency and productivity.

Processors use incentive schemes or competitive contracts to encourage farm efficiency and productivity. In traditional competitive contracts, farmers competed against each other in a pool-based system where top farmers would get a bonus and bottom farms may lose money. This style of contract is becoming obsolete as customers see them as the rich stealing from the poor. Modern day contacts are using incentive schemes to encourage and reward farmers for being compliant with paperwork, farm appearance, farm efficiency and productivity. These new incentive schemes have abolished any competition within a company and have opened channels for sharing information between farms. The more traditional competitive contracts may have encouraged farms to be more efficient and innovate however they acted as an inhibitor for the sharing of knowledge between farmers.

Lack of labour in the agricultural sector is a growing issue that needs to be addressed. The increase in technological advances has fast tracked innovation being implemented in many processing facilities to help address the lack of labour. The lack of labour is driving the implementation of automation in processing plants and farms throughout the world. Recent years have seen an increase in mechanical harvesters to catch poultry, the invention of shed monitoring robots and with the increased capability of drone technology farmers picking up dead birds or fixing broken drinker lines may become a thing of the past.

Farmer Led

Farmers hold the key to how innovative their farm can be. Innovation that is led by farmers either increases profitability and efficiency or makes a job faster and easier.

Farm income and profitability is one of the main drivers for farmer led innovations. Farms come in many different business structures and farmers attitude towards risk and debt levels can differ greatly. Innovative practices or new technologies are often expensive, and the farm must have additional funds available to implement them. When farmers have surplus income, they are more able to innovate, however this is not always the case.

The lifespan of poultry farms is often relatively long with some farms several decades old. Equipment companies enter into a long-term relationship with farmers that install their products. Equipment companies in the USA have partnered with suppliers to install entire shed systems which save farmers money on their install and encourage more modern installations. Through these relationship equipment companies have great power to encourage innovation in the industry.

In Australia, the main system implemented in tunnel ventilated sheds was the Rotem control system, this is quickly being overtaken by the European giant Scov. Scov have representatives on the ground in Australia that build relationships with their customers. Much like the USA example, this relationship encourages the installation of better products. Equipment company representatives that can provide information on new and improved technologies help fast track innovation.

Farmers are in control of what materials they use to construct their sheds. While the use of material is very regional and dependant on cost and availability of products farmers can use whatever materials they wish. Traditionally, building design has been constrained by available materials. New building materials and the use of 3d printing technology could change not only the look of a farm but how they operate.

Consumer Driven

In today's society, consumers are having a bigger influence on the way that products are produced. Consumers want to know more about where products are coming from and want to ensure animal products have been ethically produced.

Supermarkets may demand particular specifications from processors to meet the demands of the consumers. Trials of new product lines and certification standards such as RSPCA certified are used by supermarkets to gauge consumers purchasing habits. Supermarkets such as Woolworths have their own quality control and welfare audits that are carried out on farms.

Animal welfare groups such as RSPCA can dramatically change on farm practices. RSPCA have set their own standards aimed at improving welfare of birds that must be adhered to by farmers and processors who wish to sell products with RSPCA certification.

Increasingly, restaurant chains such as KFC and McDonalds have requirements for better welfare standards and traceability. Some chains may require independent audits of processors and farms.

Barriers to innovation

Some of the drivers for innovation also act as barriers. Similar to the drivers for innovation the barriers can also be generated from four different areas:

1. Industry;
2. Processor;
3. Farmer; and
4. Consumer.

Barriers to innovation are interesting in that some were developed to help improve performance in the industry and have unintentionally had the opposite effect. While other barriers have developed as the industry has matured.

Industry

Industry guidelines are based on practices that have been used successfully for many years and have demonstrated desired results. However, because guidelines can become ingrained in industry standards and government policy, they can inhibit future innovations.

An example of policy potentially limiting innovation was observed at the farm of Derrick in Ontario, Canada. A common standard in many countries is mandated bedding depth on the floor of a barn / shed. This is common practice and allows the birds to have soft bedding that will absorb moisture and create a microbially beneficial environment for the birds to dust bath and display natural habits.

Derrick's poultry farm has two separate facilities. One is an older style double storey barn while the other is a single storey dual shed new build. The new build is equipped with some of the latest equipment including underfloor heating. After much research Derrick found the most effective way to run this style of heating was with no litter.

There is no doubt that Derrick is an innovator in the industry but if he had to comply with standards that required 5cm of litter to be spread on the floor he may not have as good of success story to tell as the litter would have insulated the heat generated by the in floor heating and this innovation would have failed like so many who have tried the system before Derrick. Derrick's farm is just one example of how policy can inhibit innovation.

New barns are bigger and have increased environmental specifications placed upon them such as environmental impact studies that require settling ponds. New build sheds are required to have concrete floors in many countries. A new farm with tunnel sheds that hold around 65,000 birds costs a minimum of $500,000 per shed in Australia, plus land and any approvals that are required. For a typical 4 shed poultry farm the cost is well in excess of $3 million.

In Canada, under the quota system a farmer must also purchase quota. An immaculate 11 shed farm in Ontario 'Ailsa Craig' had quota for three million kilos of turkey per year. With quota costing $11 per kg this farms quota alone came with a $33 million price tag and this is before any of the barns are erected or land is purchased.

Figure 5: The Author visited Ailsa Craig in Ontario, who have a quote for three million kg of turkey per year

Increasingly large companies such as the one mentioned above 'Ailsa Craig' are purchasing large amounts of quota. Bill Mitchell from Egg Farmers of Ontario explained that this can be problematic for the quota system and how it is viewed by the public if the quota were to be in the hands of only several large companies.

The trend of large companies purchasing and managing several farms increases the difficulty of entry into the industry. The financial barriers to entry into the industry leave many farmers cash poor. As the farmers cash is tied up in the initial investment it takes time for funds to become available for new innovations on farm.

Processor

Companies that have a large market share may like all their facilities to be similar with the same equipment in each facility. From a managerial standpoint this is a great idea as it allows the parent company to easily compare and rank different managers to each other. In regard to innovation this can be very inhibitory. Sanderson farms in the USA have set very specific specifications for their shedding equipment and shedding set up.

An unanticipated barrier to innovation created by processors is in the creation of long-term contracts or through the use of the quota system in Canada. The older style contracts were often competitive contracts which unintentionally increased secrecy within the industry and inhibited sharing of information between farms and within companies.

Today integrated companies try to incentivise good performance with bonus schemes. Pilgrims in the US use an incentive program to help maintain buildings in a neat and tidy manor and keep paperwork up to date. Other companies may penalise growers for non-compliance to some of their internal standards.

Farmer

Farmers are reluctant change from what is normal in their area, or to something they may not have been exposed to. Farms in a small area of North Carolina all have porches over the ends of their sheds, while many new builds in Ontario were red and many new builds in Australia are green. Turkey farmers in Australia are reluctant to put in a tried and tested Ziggity brood drinker that 80% of Canadian farmers are using because they have not seen this technology used in Australia

The poultry industry can be a very tight-lipped community. Research on the internet is often a difficult pursuit. Farmers that acquire insight often visit other farms, read industry publications and attend conferences. Many farmers do not go to these lengths and see that time off the farm is time away from attending to their animals, not entrusting care to other people, or not having the labour to do so.

The USA and Canada have technicians from large equipment and breeder companies that can supply information to growers regarding new equipment and technologies on the market. Suppliers in the USA offer package deals when constructing new builds. Many companies in Australia lack even basic technical knowledge and support. Companies such as Scov now have a good marketing base in Australia and are starting to get more equipment in sheds due to their presence in the country.

Long term farmers or generational farmers that may have seen many innovations fail may show resistance to newer ways of doing things. Farmers that are entering the industry today are from all different backgrounds and bring quite varied skills and beliefs to the poultry industry. In Canada, Mennonite farmers have begun to enter the industry. Mennonite beliefs require them to use different style heaters and technology to what you would find in a modern broiler barn.

Consumer

Animal welfare groups may act as both a driver and a barrier to innovation. Welfare groups have their own agenda which often does not line up with poultry processors. Some of the requirements from welfare groups such as the RSPCA increase the cost of production of a poultry operation. For example, RSPCA require greater depth of litter in sheds and stocking densities less than a processor may usually stock the shed at.

Figure 6: Pastured chickens, as noted while conducting the research (Source: Author)

Urban sprawl is increasingly encroaching on areas where poultry farming was once a dominant feature of the landscape. A PIANZ vet (Kerry) explained that innovation or even compliance to existing company regulations within Tegel's operations around Auckland, NZ have halted due to land prices. Farmers are no longer up grading their sheds, instead waiting for developers to come and offer to purchase their properties.

Many poultry farms in Western Sydney are also seeing the same effects of urban sprawl. The new Badgerys Creek Airport has bought up much of the land around these areas and sent land prices sky high. Furthermore, difficulty in getting DA approval for new and expanding farms is a major roadblock for any poultry business. Poultry farms in and around Auckland, NZ can no longer expand the footprint of their sheds, forcing poultry farms out of the city.

Chapter 4: Government Regulation

Government develop regulations such as animal welfare codes of conduct and national biosecurity requirements. They are often written by veterinarians or other industry experts before being open for public consultation to determine whether the industry finds the requirements reasonable. The codes and regulations are regularly updated.

Well written, well researched codes are a good tool in the industry. The codes and standards are used by integrated companies and other organisations to ensure farms are meeting minimum operating standards. The standards often relate to larger issues such as food safety and national biosecurity. Standards try to reflect global trends and concerns in the industry. For example, numerous cases of Avian influenza in recent years have dramatically changed some of the rules and regulations implemented into updated standards.

Increasingly, concern outside of the industry is changing how the poultry industry operates. The World Health Organization (WHO) has implemented programs to help reduce antibiotic use in poultry. The aim of these programs is to manage antibiotic resistant bacteria in the human population. Furthermore, media campaigns through social media and public figures are changing the demand for products with perceived higher animal welfare standards.

Regulation through government and other organizations is crucial for the protection of the industry and public health and safety. Regulations ensure farms meet a certain standard to produce safe, clean food. However, regulation is often based on common industry practices over the years and may inhibit innovation.

The NZ animal welfare code states that litter must be used in broiler sheds to a certain depth (Code of Welfare, 2012). This may inhibit innovative practices such as those used on Derrick's farm in Canada where no litter was used, and bedding temperature was managed using under floor heating. If litter had to be used in this instance the innovation would have failed or could not have been implemented in the first place.

Figure 7: A typical litter shed in Canada (Source: Author)

Chapter 5: Industry Structure

Different types of industry structures may affect how farms operate. In the USA, NZ and Australia the industry is based on contracts, while the Canadian industry is supply managed. This section of the report compares and contrasts the two systems to determine if there is an effect on adoption of innovative practices.

Supply management

Supply management aims to control supply through a marketing board. In Canada, both dairy and poultry are supply managed. In his paper: 'Canada's Supply Management System', Khamla Hemnthavong explains that a successful supply management system relies on three basic pillars; production control, pricing mechanisms and import control. Quota limits are set by a national board based on provincial demand. These limits aim to minimize price fluctuations by preventing over or under supply of a product. National agencies may also impose penalties when growers over produce or under produce.

Bill Mitchell from Egg Farmers of Ontario explained it well in regard to eggs. "*If a bakery requires eggs and they are not available due to shortages (e.g. disease) bakeries may find a substitute product and by the time the supply of eggs has recovered, the business from the bakery may no longer be there".*

Supply managed farms receive a guaranteed minimum price for the product they produce. Farmers negotiate with processors for a fair price based on their production costs and market conditions (Khamla Heminthavong, 2015). Bill Mitchell again explained the importance of pricing mechanisms. "*If eggs were to increase from $2 a dozen to $12 a dozen cooks may look for alternative ingredients, once the egg price normalizes the cook may have found an alternative product and the egg market may not recover its position*".

Producers must purchase a permit generally referred to as 'quota' as a right to grow and sell their product (Library of Parliament Research publications). Quota was initially handed out to farmers free of charge, in recent years the rise in quota prices means that the quota has become a major asset for quota-controlled businesses. Many provinces fear that increased quota prices will result in excessive amounts of debt for farmers who purchase new quota and so have capped the quota prices. Quebec has capped Quota at $500 per square metre for turkey production (Khamla Heminthavong, 2015).

Farm cash flow on the quota system is guaranteed, however a batch must be completed before any income is produced. A batch of chickens may be six-to-eight weeks long, a turkey batch could be as long as 20 weeks. Managing cash flow within a supply management system could also hamper innovation as the farmer needs to have money placed aside for all the inputs required to complete the next batch of birds.

The quota system ensures a fixed price at the end of each batch of birds. The farmer has guaranteed income at the end of the batch. To increase the amount a farm earns they must

reduce outgoings during the batch. Like any business this may be done in several ways. The farmer may cut back on inputs or increase efficiency. Cutting back on inputs such as electricity, ventilation, feed quality, maintenance and upgrades in the short term works well, and the cash flow looks good. In the long term, the repairs build up and the barn becomes outdated, the amount of money it takes to upgrade the sheds to be in line with new facility standards continues to grow and often becomes too much. The farm continues down the path of not innovating until the barn becomes too costly to upgrade and becomes obsolete.

Increasing efficiency through constantly upgrading equipment, purchasing quality feed, ventilating for improved performance and animal welfare produces a quality product and keeps the barns up to date and able to compete with newer facilities. Egg farmers of Ontario recognized that new farmers or a farmer that has years of experience managing a conventional or cross flow barn would not have the knowledge to run a modern tunnel barn. They implemented a program to provide mentors that have the skills and experience to help farmer's up skill and acquire the necessary knowledge to upgrade their facilities or increase efficiency on farm.

Integrated companies

The poultry meat industries in USA, NZ and Australia are all dominated by large vertically integrated companies. Vertical integration means that a company has control over the supply chain including; grandparent stock, breeders, hatcheries, feed mill, processing plants and the contract growers.

Farmers supply the land, building and labour to the companies and the companies offer a contract with rate per bird or rate per square metre of shedding. Contracts differ from country to country; many in Australia are five, plus five-year contracts. After five years either party has the ability to change or renegotiate parts of the contracts. There are many clauses in the contract that can often be used to facilitate upgrades or change the running of a farm system if implemented.

Contracts give farmers a guarantee that their farm will produce income for a specified term. The contract requires either party to give notice if wanting to get out of the contract allowing the other party time to facilitate the change. Contracts may also be used as a tool to implement change, enforce compliance and encourage productivity.

One way of encouraging productivity is using a payment scheme based on how well a farm performs. A common performance-based bonus scheme used is a pool system where farms of the same type (i.e. free range, barn, organic) are pooled together and compete against one another for a bonus over a number of batches. A pool system can work in two ways; farms at the top that consistently perform well can increase their on farm income, however farms that are on the bottom of the pool must work hard on improving performance or they may lose some of their potential income. Farms that are constantly underperforming may lose their contract.

A pool system is an older style scheme that has been used for many years. A pool is good at increasing productivity by keeping farmers working towards increased average live weight and improved feed conversion. However, this system increases competitiveness, farmers often become secretive and do not share ideas, which may decrease the uptake of more innovative practices. Some US companies have recognized that this competitiveness means that in pool systems top growers take money from the bottom ones. These companies have now implemented a different system where the grower only competes against themselves and a specified standard. This encourages growers to be more compliant, giving audit bonuses which look at parameters such as correctly completed paperwork and farm appearance. The farms are also encouraged to perform better with a performance bonus based on Feed Conversion Ratio (FCR) and average live weight.

Contract growers on both the pool scheme and the bonus scheme got paid comparable amounts. The main difference was in the mindset of the growers and a change in company culture. Growers were more willing to share ideas openly and mentor newer or inexperienced farmers into the industry under the bonus scheme.

Cashflow for contract growers may be different between companies and countries. Generally, farmers are paid monthly with an additional payment paid at the end of a batch based on performance or meeting other parameters that are set out by the company they are contracted to. Getting paid consistently throughout the year helps farms to better manage cashflow. This enables farms to plan for upgrades, repairs, and maintenance. Farmers can increase on-farm income by either performing well in the pool, meeting bonus requirements, decreasing inputs or increasing efficiency.

Contract growers do not have as many inputs as supply managed farms do. Inputs that contract farms have differ between companies, some have gas, litter and electricity paid for while others have it incorporated into their grow fee. Growers may order less litter than required or decrease ventilation to reduce gas and electricity usage. However, decreasing inputs such as those above is becoming more difficult as companies focus on animal welfare and litter quality increase.

Farmers may increase the efficiency of their farms by updating equipment or management practices. Integrated companies often have insight to where the global poultry industry is headed; this insight may be implemented into a contract to drive innovation or change. An Australian example was when companies required growers to change or upgrade shedding to tunnel ventilation to grow for them. The contracted system also encourages innovation though the pool system, for example mechanically ventilated shedding can run at an increased stocking density of birds in the shed, if a grower was paid per bird the on-farm income would be greatly increased. A conventional farm would struggle to compete with the tunnel ventilated shed for performance which would further cost the grower.

Chapter 6: Farm Structure

The poultry industry has thousands of farms and sheds globally. Farms may be owned by a family or a company. Many farmers come from different backgrounds which may dictate what equipment and practices are used in the sheds. Some farmers are new entrants while others may come from generationally owned and run farms. The diversity of farm ownership and managers can affect the adoption or lack of adoption of innovative practices on a farm.

Figure 8: A typical turkey shed in Canada (Source: Author)

Farm ownership

In the past, poultry farms were predominantly built as a family owned and operated business. Today the poultry industry is seen as a good bricks and mortar type investment and provides good cashflow. This is encouraging more businesses to invest in poultry operations.

The type of ownership of a poultry farm can influence how it is operated.

Large companies often have enough money to construct well built, up to date facilities. Companies want farms to run efficiently and invest in technology to help with this. Furthermore, companies may invest in more automated and more remote monitoring equipment to enable farms to be monitored from afar. Company goals can have a large impact on how innovative a farm is.

Alternatively, some larger companies minimize spending and run operations to minimise month to month expenses and avoid investing in expensive equipment. One company in USA specified the type of equipment and how farms are laid out. From the companies' point of view this easily lets them compare the performance of managers across farms. However, from an innovation point of view facilities are built on tried and tested equipment rather than state of the art more innovative equipment.

Family owned businesses may be acquired as a lifestyle choice in aim to spend more time with family and not locked into strict working hours. Family owned farms may acquire large amounts of debt to purchase the property and don't have the free cash available to upgrade facilities. The amount of innovation on a family farm may be based on individual circumstances. Farms that have been passed down by older generations may vary greatly in uptake of innovative practices.

The debt on these farms are generally low and cash flow good. Shedding that was not upgraded by the older generations can result in the problem of increased repairs and maintenance costs which increases the running cost and the time taken on farm to carry out everyday tasks. Another difficulty that can arise with generationally owned farms is the unwillingness for the older generation to let go and give the younger generation of farmers the chance to make changes. The older farmers often have their own way of carrying out tasks and do not see the need for change.

Farms that are run by small businesses vary greatly in structure and the ability to innovate. The amount of debt on these farms varies greatly and has an impact on the amount of innovation.

Grower traits

The poultry industry is made up of a diverse array of growers and managers. As in any industry farmers come from many different backgrounds and bring many different traits. Some people are naturally innovative and have a need to test and push boundaries of anything they try. Innovative farmers thrive on improving a practice or completely changing the way something is done. Innovative farmers have an entirely different mindset to many other farmers, money is not seen as a barrier, they are constantly on the go with one project or another. An innovative farmer has the desire to innovate, however this can result in problems with companies that have standards that are not to be changed.

Farmers of different cultural backgrounds are seen throughout the globe. All backgrounds bring something new and different to the poultry industry. In Canada, Mennonite farmers are limited by the technology they can use in the shed. Mennonite farmers must run off generators and are limited to the style of heater they can use. In Australia, farmers from a Maltese background are common, these farmers often have high standards and run a neat and tidy farm. Maltese farmers have strong work ethics, this is shown in the way they run their farms.

Generational farmers often have low debt levels. Farmers can often be hard to change as they have always done things a particular way and do not want to change or cannot see the point in changing

New entrant farmers may be eager to learn the poultry business. New entrants can often have large amount of debt which may dictate the amount of innovation they are able to implement.

Many family farms get into the poultry industry to get away from the fixed hours of a nine to five type job. Family farms may also have large amounts of debt. Family farms are diverse in that they may be eager to learn. Family run farms often have long term goals to provide for their family and perhaps have their children run the farm one day, this goal dictates the amount of innovation on the farm.

Chapter 7: Industry Trends

The poultry industry has become renowned as being a very innovative industry. Over the past 50 years change has been driven by improved performance through increased average liveweight and improved feed conversions. Going forward, change will be driven by a number of different factors; reduced antibiotic usage, increased animal welfare concerns and availability of resources to name a few. Bird integrity and disease resistance will be increasingly important in breeders and broilers while management practices aimed at animal welfare and biosecurity will drive innovation on farms.

Reduction of antibiotics in the poultry industry is a current global trend. Antibiotic free production (ABF) requires coccidiostats to be taken out of feed rations. This is one of the main challenges to ABF. Coccidiosis vaccine trials are occurring in many companies. The use of the vaccine has been met with many challenges including correct coccidiosis cycling and the occurrence of necrotic enteritis.

Avian influenza is becoming a common seasonal occurrence in the poultry industry. Areas that have been affected by outbreaks of influenza have increased biosecurity measures to help prevent outbreaks in the future. Companies and Governments are reviewing biosecurity regulations and changing rules in regard to compensation when outbreaks occur.

Beak laser treatment or beak trimming practices have recently been banned in The Netherlands. Laser treatment has been a controversial topic for many years. If the ban on laser treatment can be successfully implemented in The Netherlands this is likely to filter though the industry globally.

Free range production is increasing globally; this has been driven by animal welfare agencies that are pushing out cage free production in the egg industry. Free range production is perceived as a higher welfare standard to barn or cage production systems which appeals to many customers. The biosecurity and environmental risks involved with free range production will increase regulation for industry in the future.

Urban sprawl and price of land is forcing poultry production to more rural regions, additionally many integrated companies are creating super sites closer to grain growing regions which decreases the cost of production. Large farms help decrease the cost of production. Newly built poultry farms consist of larger shedding and more sheds. Most newly built shedding is required to have concrete floors which help with disease. Bio security is a challenge on larger farms especially if they have multiple age flocks.

Increasingly there is a great focus on animal welfare. Litter quality and foot pad scores are becoming a parameter that companies are measuring and looking to improve. Controlled atmosphere stunning in processing plants is a more consistent and reliable method of stunning that is likely to become mandatory in many countries.

Following animal activist media campaigns in Europe slow growth broilers have started to come on the market. The broilers get to market in 90 days and have been incorporated into top breeder, Aviagen's breeding programs.

As farms are pushed out to more rural areas and farms become larger, resources in many areas are already becoming stretched, this coupled with the growing requirement for single batch litter will increase the demand further. Litter type and availability will be a growing concern in the future.

Increased regulation for bio security and environmental issues will change many on farm practices. Increasingly, removal of waste products from farms will become an issue. Litter and bird disposal is starting to become a rising issue in Australia and globally. Traceability of all products on and off farm is also an increasing requirement. This may drive more biogas plants to be erected in the future as is the case in The Netherlands.

Poor water sanitation has frequently been found to be the cause of many Avian influenza outbreaks globally. An increased focus on water source and effectiveness of sanitation to minimize disease is already in the spotlight of many companies globally

Conclusion

Regulations imposed by government, animal welfare agencies and industry bodies can act as both drivers and barriers of innovation. Well written insightful regulation can serve the industry well by driving it toward innovative practices and ideas. However, regulation that is based on consumer trends or traditional methods or standards can act as an inhibitor of innovation. Increasingly the minority is driving the industry toward change that is increasing the cost of production by influencing regulators.

Supply management ensures the market is stable for both farmers and consumers. A well run supply management system can still be just as innovative as vertically integrated companies. Supply managed farms showed the same diverse range of farmers as other systems. Regulation by the government or industry bodies becomes important to ensure that supply management systems are keeping up with global trends.

Integrated companies often show insight into global trends and encourage change and compliance to upcoming trends through contracts. Integrated companies can act both as a barrier and driver for change.

Growers have varying backgrounds and traits that determine how a farm is run. Certain characteristics such as work ethic, family-oriented priorities, generational farms and cultural background all play a part in how innovative a farm may be. Some farmers have an innovative nature that drives them to continually investigate and improve while others are happy with a pay check that comes at the end of the month.

The poultry industry globally is continuously changing, increased public awareness of animal welfare issues; disease outbreaks and ongoing concern for antibiotic resistance in the industry are driving forces that are influencing the poultry industry today.

The adoption of innovative practices has many drivers and barriers. The key to adoption on one farm maybe completely different to uptake on another farm. Many farmers are not aware of or are ignorant to problems on their own farms. Creating awareness of new ideas is the beginning to encouraging innovation. Motivation though education creates possible solutions to these problems. Communication of what other farms in the area are doing or where industry trends are heading is a great way to encourage farmers to innovate.

Recommendations

- Communication between companies or industry bodies and growers will help keep farmers informed of changing trends and regulations in the industry.
- Better cultures should be created within integrated companies through bonus schemes that encourage rather than penalise growers.
- The industry needs to be proactive to regulations and drivers of change in the industry.
- Education and exchange of ideas within industry though conferences and break out discussion groups is a great way for farmers to openly discuss issues within and across different companies and perhaps even countries.
- Mentoring programs need to be created to help bridge the knowledge gap between farmers that run a traditional style farm and modern barns.
- When implementing new regulations farmers need to be informed about why it is important to implement a new practice.

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Plain English Compendium Summary

Project Title:	Drivers for Innovation in the Poultry Industry What are the barriers and drivers for adoption of innovative practices in the poultry industry?

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Objectives

- Investigate national regulations imposed by governments, regulatory bodies and animal welfare agencies to determine the effect of litigation and external body standards.
- Compare and contrast different marketing systems to determine whether there is a difference in uptake of innovative practices e.g. quotas vs integrated companies.
- Investigate the effect of integrated companies and company structures on the adoption of modern sheds and practices.
- Investigate a range of characteristics possessed by growers though out the regions visited to determine if there is a particular trait that determines how innovative a grower may be.
- Identify trends in the poultry industry globally that are likely to affect Australia.

Background

The poultry industry has a vast amount of new technology available to improve efficiencies of shedding and increase productivity. Farmers level of adoption of these innovative technologies are generally low. Identifying key factors that contribute to increasing the rate of adoption in the poultry industry may help organisations to develop programs to encourage uptake of these innovative practices.

Research

The author visited Brazil, Chile, USA, Canada, The Netherlands, Italy and New Zealand. On these trips she conducted interviews with industry organisations, farmers, researchers from universities and representatives from major poultry companies in each country. Furthermore, she attended conferences addressing key issues in the poultry industry.

Outcomes

There are many factors that influence the adoption of innovative practices in the poultry industry. Farmers and companies are forced to comply with a minimum standard enforced though government regulation. After the minimum requirements are met the rate of adoption varies greatly. Increasing communication and education of growers through conferences or mentoring programs may help increase the rate of adoption.

Implications

The poultry industry needs to become more proactive in the planning process of litigation to ensure regulation is set out by the poultry industry for the poultry industry. Farmers and companies need to keep up to date with industry trends implement programs to continue to expand knowledge and innovate.

Publications

Nuffield Australia National Conference, Melbourne, September 2018