

Future Housing Systems for Australian Free Range Egg Production

A report for



By Thomas Moore

2019 Nuffield Scholar

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Executive Summary

The Australian egg market is a strong one but is going through a transition, of sorts, away from caged eggs. Growth in the free range sector is substantial and investment into new housing systems is incredibly costly and not without risk. Producers need to be careful that free range eggs do not become the commodity egg and this can be done in several ways.

Growth and development should be planned so the market area covered can sustain the production system. There are many examples of small producers in northern New South Wales (NSW) that jumped onto the free range egg idea, spending plenty of time on their vision and marketing, but not enough time on costing their production system and forecasting expenses. This has resulted in many eggs being sold, often direct to consumer, but still end up not making any money. The housing choices that are made long before the hens are ordered must be as efficient as possible, but the farmer must know that it does not have to come at the cost of the hen. Modern housing systems without doubt should put the needs of the hen first and the farmer's needs second.

All systems should be looked at in person, ideally within a shed with hens. The research carried out for this study investigated several examples of the same equipment installed in different sheds, but the birds' behaviour could not have been more different. One shed had good ventilation and were using it, the other had the good ventilation system but were not using it effectively, having a vastly different experience with bird behaviour and egg quality. This can be driven by cost, but the initial saving in power will likely be outweighed by the poor production from the hens and lower egg quality.

Another important consideration when viewing sheds is taking time to watch bird behaviour while the birds are living within the equipment. That can indicate how well it is designed and how well the birds have learned to use it.

Independent Australian producers are restricted by the availability of their choice of reared pullets, largely only having floor rear birds to choose from. This is a relatively young industry and will need to grow substantially as Australia grows and egg demand increases.

Investment into aviary rearing systems for birds may need to be incentivised as the cost of the rearing system is very high. How much of the increased cost of the pullet can be passed on to the egg producer is yet to be seen. Do not consider placing floor reared birds into an open aviary system. If floor reared pullets are the only option, then make sure the equipment manufacturer is aware of this from the beginning.

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Foreword

As a first-generation free range egg farmer myself, the impetus of applying for a Nuffield Scholarship was primarily for the research it would help me achieve for my business. With my wife, we operate an 8,000-bird free range egg farm near Tenterfield in northern NSW. We grade, pack and market all our own eggs and have seen strong local demand for our product.



Figure 1: Author and 2019 Scholar Tom Moore

Due to the small nature of our operation, and the fact that we market all our own eggs, we decided to build just one shed but have this split into four age groups. This is not possible due to regulations in some countries because of increased biosecurity liabilities. For example, it is very hard to sanitise a section when there are birds just through the fence. That being said, it allows us to reduce the cost of our initial investment and still be able to market eggs year-round, with only a 25% drop in production when a batch of birds are removed.

After operating our farm for only a short period, it was obvious that some of the birds' natural instincts and behavioural traits were not being accommodated. Even though we have a new shed with all new equipment, it appeared to us that there must be a better way. It turns out there might be but there are significant barriers to that progression.

This report was written and researched to gain an understanding of the direction of the free range egg industry globally with respect the future design of housing (or egg laying) systems.

As part of my scholarship, I visited the United States of America (USA), Singapore, Philippines, Hong Kong, China, Germany, The Netherlands, United Kingdom (UK) and Ireland. The diversity gained from my experiences in this travel has hopefully given me the ability to filter what might be appropriate in the current Australian market. I hope that I have been able to demonstrate that I have considered not only the economic benefits of the production system to the farmer but also any other driving factors which result in the choice of housing system. Bird welfare and consumer perception are going to be critical decision drivers.

Of all the production systems, eggs are a very affordable source of protein all over the world, and the system that they are produced in is what drives this cost of production and efficiency. Most importantly, happy hens lay lots of great quality eggs.

Acknowledgments

The Nuffield Scholarship program was introduced to me by my wife Jo about three years ago. At the time I remember profusely arguing that I, and our business, was not ready for this sort of undertaking. When applications opened the following year, I finally jumped on board and submitted my application. If it was not for Jo, I know I would not be a Nuffield Scholar.

Jo not only gave birth to our first child four days before I left for my six-week Global Focus Program, but also worked every day thereafter to keep our business running and our little bundle of joy (David) alive. How she managed all of this I will never know but I will be forever grateful.

I would also like to thank Guy Hebblewhite, a 2013 Scholar, who contacted me after my application was submitted. He was my first introduction into the Nuffield Australia family and at the time was the Chair of Nuffield in NSW. He laid out the requirements clearly and reassured me that I would not regret applying. He gave me the confidence I needed to follow through with all the commitments and calmed my nerves on interview day. Thanks Guy.

Finally, I would like to thank The Royal Agricultural Society of NSW Foundation (RASf) and their representative Cecilia Logan. Foundations like the RASf are what makes Nuffield Scholarships possible. The generosity of their support for me and my scholarship was overwhelming, and I look forward to paying it forward in the future in whatever way I can.

Abbreviations

ACCC: Australian Competition & Consumer Commission

GFP: Global Focus Program

NSW: New South Wales

RASF: Royal Agricultural Society Foundation

UK: United Kingdom

USA: United States of America

USDA: United States Department of Agriculture

Objectives

The report aims to explore:

- Look into trends of housing systems being installed globally.
- Identify driving factors for the investment in a particular system.
- Identify market drivers in different countries to see if they align with the Australian market.
- Make recommendations for Australian farmers to consider which system might be best for their production, scale and market.

Chapter 1: Introduction

Australians enjoy their eggs. The Australian consumer buys on average 247 eggs per person per year of which 47% are free range. But this 47% makes up 56% of the total sales value (Australian Eggs, 2019a). When this is compared to the UK for example, consumption per capita is 199 eggs and a free range market share of 56% (UK Egg Information, 2018). So, the Australian egg market is exceptionally strong, and consumers are showing a trend towards free range eggs.

It must be pointed out however the cage and barn egg segments are still a vital component of the egg market as shown by over 50% of consumption coming from these two remaining sectors (Australian Eggs, 2019b). Consumers vote with their dollars, and this shows that many sources of protein and choice are still especially important in today's market.

Each of these housing systems have their benefits for both the birds and the farmers and there are benefits to the consumer too. Not everyone can afford free range eggs and they should have the option to choose if it is available, a cheaper but no less nutritious source of their eggs. The trends in the market in Australia are heading into the direction of a more free range focused egg market. For that reason, this report will focus only on the free range housing options.

1.1. What is Free Range?

As of 26 April 2018, the Australian Competition & Consumer Commission (ACCC) (2018) states that:

Under the new Standard, egg producers cannot use the words 'free range' on their egg cartons unless the eggs were laid by hens that:

- *had meaningful and regular access to an outdoor range during the daylight hours of the laying cycle.*
- *were able to roam and forage on the outdoor range.*
- *were subject to a stocking density of 10 000¹ hens or less per hectare, and that outdoor stocking density is prominently displayed on the packaging or signage.*

From the basic minimum standard as stated above, the Australian free range egg market ranges from a few hundred birds per hectare to 10,000 birds per hectare. These lower density production systems will be investigated for the purpose of this report to see if they are a viable alternative to the large scale more intensive production system.

¹ For a point of clarity, that stocking density allows for one bird for every square meter outside.

1.1.1 Free range egg production systems

A production system is the term given to the equipment working within a shed or barn to produce eggs. This includes feed, water and nesting equipment, and it can also refer to how the equipment is laid out. Below is not a comprehensive list but does show the major production methods of free range commercial eggs.

1. Group colony

Group colony is a floor-based production system inside a shed. Raised areas are normal, allowing the birds to roost and keeps the birds away from the majority of their own litter.

2. Multi-tier aviary system

Multi-tier aviary systems are an evolution between trying to stimulate the bird's instinctive desires and giving the farmer equipment that keeps the birds happy and produces lots of clean eggs.

Figure 2 is an example of just how different the aviary laying system initially looks to the more traditional “flat colony” style. The farmer is looking up to the birds that want to be in the higher position, often these can be more dominant birds. All birds are free to roam throughout the system, with feed and water on each level. Generally, there is only one area for nesting that runs the entire length of the shed.



Figure 2: Aviary example. Source: Vencomatic, 2021

3. Mobile multi-tier aviary:

A mobile production method, allowing the farmer to rotationally graze their hens either alone or behind a suitable companion grazer to keep the grass short for the chickens. Fundamentally the layout of the equipment in these mobile trailers is very similar to a stationary installation but there are limitations on size and therefore bird numbers (the structure must remain movable in all-weather/ground conditions and some countries are legislated to ensure this happens). In Australia, these eggs are marketed as “pastured” eggs referring to the premise that hens are free to graze.

This is a brief summary of the free range production methods available to the Australian egg producer, within these groups there are many design differences and distinctions to each. This report will aim to explore some of these further.

1.1.2 Does it look right AND pass the first impressions test?

Throughout western Europe and the UK, the author came across many new facilities that had visitor areas and viewing platforms built into the initial design of the shed. Producers are clearly conscious that there needs to be a connection with the customer and the farms that produce their eggs. This appears to be a great way of building trust with the consumer – but will any of these systems look better to the consumer than others?

1.1.3 Will it all pay off?

Investment in new laying equipment and houses can cost a staggering amount of money. This is often referred to on a \$/bird housed. This number is easily entered into production forecasts to give a payback period (assuming risks in market volatility for sales and inputs).

Modern egg production is often a business of having to take very large risks to gain moderate rewards and with ‘free range systems’ the added biosecurity risk of having birds outside, the word “certainty” is rarely used. Where possible the farmer needs to decide on a production system that is still going to suit market trends in 10 to 15 years’ time.

Chapter 2: Production Systems of the Free Range Egg Industry

2.1 Group Colony System

Group colony systems feature a central nesting area, normally running the complete length of the shed with a raise floor area either side of the nests. Figure 3 shows a modern group colony system in France with the birds having additional perching area. From right to left there are nests, water, feed and perching. These birds will also have pop holes to access the outdoor range area.



Figure 3: Colony Production System. Source: Author, France, 2018

There are a huge number of variations of this layout to suit the producer, the climate and the breed of bird. The author, for example, has a floor area included within the shed to allow the birds to have a dry dust bathing area even in wet weather. This is a decision entirely based on bird wellbeing as it only increases cost and the challenge of maintaining excellent air quality.

Advantages to these system styles include a low initial investment in equipment, they are simple to manage and operate, and there are usually minimal issues with birds knowing how to use the equipment because of natural instincts.

Areas of concern include bird contact with their own litter causing diseases and parasites; eggs mislaid or not laid in the nest, leading to dirty eggs or worst-case, hens learning to eat eggs that get broken; flat open areas can exacerbate the birds' natural behaviour of having a hierarchy, developing into aggression and cannibalism; and there will also be some additional management preventing and dealing with these behavioural issues. (Tomesen, 2019) a producer in The Netherlands, said *“that the biggest problem he had with this style of system was finding a stock person that could see the problems with bird behaviour before they*

started.” This highlights a major issue that Australian farmers are currently suffering in the form of high wages and a skilled labour shortage.

When the author was in the UK speaking to producers about deciding factors for one system or another, Ted Tyson (Tyson, 2019), a producer from York in the UK, spoke of consumer perception of the stocking density in the shed and how it looked compared to another style of system.

Figure 4 gives the perception that this shed is overstocked, and the birds may be unhappy accordingly. It is quite likely however the birds prefer it on the floor because they can scratch and dust bath and they have a preference to be close to one another. It is also important to add that the general nature of brown laying hens will be attracted to people whereas white birds will gravitate away.



Figure 4: A poor perspective of housing conditions. Source: Daily Telegraph.

2.2 Multi-Tier Aviary's

2.2.1 Where did they come from?

It is thought that the Swiss were the first to try and develop a “cage free” aviary system. Some of these designs date back to the 1980s as Europe moved away from caged egg production (Poultry World, 2017). These early designs were a hybrid of the group colony system explained earlier, however with nests on the walls and hand collection of eggs. The feeding and drinking systems were then built up on several levels in the middle area of the shed. The primary disadvantage of these early systems was that bird density per square meter was very low, with each house containing only 600 to 6,000 birds. This greatly limited potential production and profits from the house. In addition to the inefficient use of space, this setup resulted in a high rate of floor eggs, although the low population of birds allowed relatively easy pickup of the eggs.

In the 1990s, producers in the Netherlands experimented with similar systems but added more birds per house, with populations often totalling from 20,000 to 25,000. These trials resulted in an even higher rate of floor eggs (6 to 10%). The high percentage of floor eggs, in combination with the larger bird population, required a lot more labour than is practical for commercial egg production. Eventually, some egg industry pioneers began building aviary houses with integrated nests, rather than keeping the nests against a wall. They also placed the water lines in front of the nests so that birds would find the nests in their search for water. Birds performed well in this innovative system, and it became the foundation for modern multi-tier aviaries. The Europeans have been developing these systems over the past 30 years, so it would be expected that a definitive best design may have come from all that work. This would not appear to be the case as one manufacturer alone has over 20 variations of aviary system. This leaves the farmer a very hard decision to make.

2.2.2. What do they look like?

A cross sectional view of a modern aviary system can be seen in Figure 5. The coloured areas are useful to see how the structure gives more surface area (counted as floor space) to the given size of a shed, therefore increasing bird numbers, but also gives much greater perching space for each bird. Within the structure is everything the bird requires for egg production: feed, water, a nest and lighting.

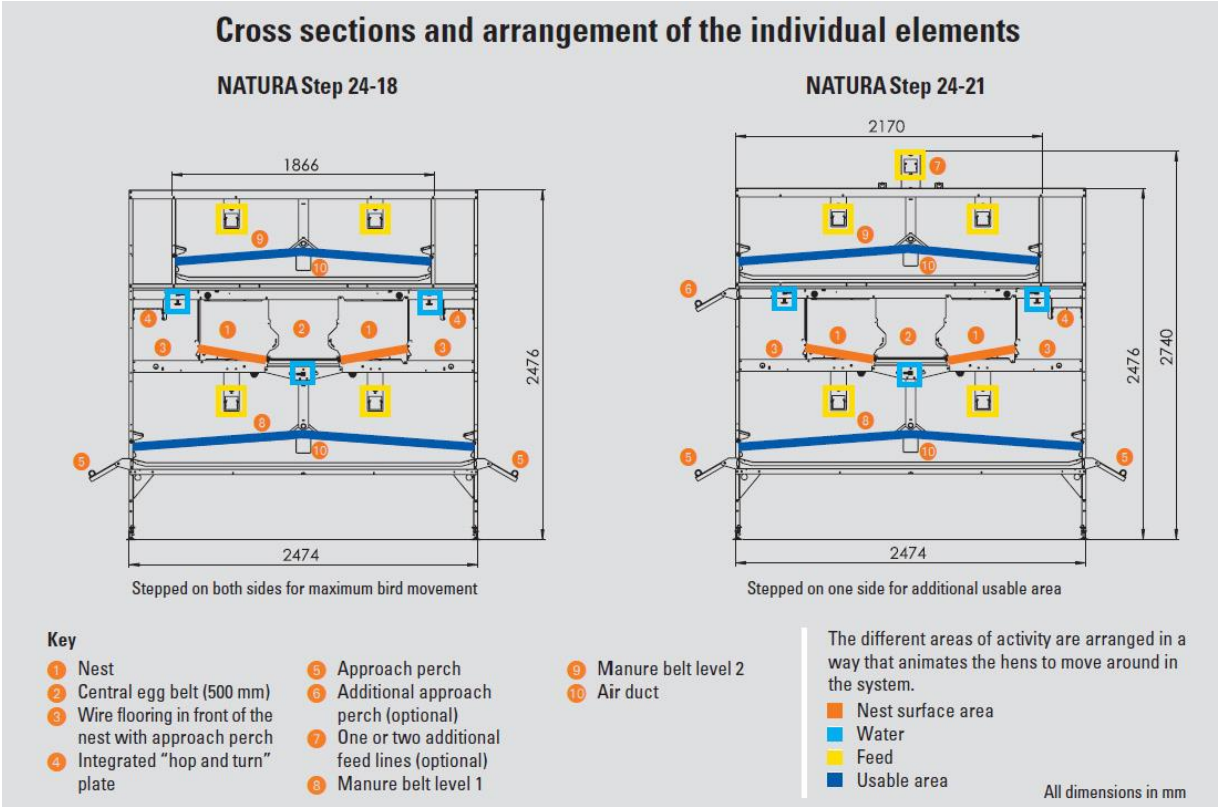


Figure 5: Cross Section of a Big Dutchman Aviary System (Big Dutchman, 2017).

The thought process behind the design of the aviary system is based around the bird's natural behaviours, and to some degree the farmer is considered second. The modern laying hen is a descendant of the jungle fowl. A ground dwelling but tree roosting bird that foraged on the forest floor all day. Open floor access and raised areas for perching come to mind as an obvious natural requirement for the hen. Unfortunately, it has taken many years for these features to be harmonised with the production of eggs, and most importantly, having those eggs laid where they are needed.

What is seen in very modern (mostly European) sheds today is similar but not always the same to the examples below. A tall, sometimes very tall (3-4m) steel climbing frame for chickens built in long rows, with hens spread through the equipment from top to bottom. On first appearances it looks like not only a sea of hens on the floor, but also walls, up to the shed ceiling. This first impression is intimidating, but once the bird behaviour was studied for some time the benefits became clear.

The first example (Figure 6) is from a free range mobile house in Germany. The orange curtains that can be seen in the middle of the equipment hide the nests. In the photograph, the area beneath the system is closed off with mesh, but once the birds are all trained to lay in the nests, this area would be opened up to allow more area to dust bath.



Figure 6: Natura Step, Germany (Big Dutchman, 2020)

The next example comes from an excellent farm that was visited by the author when travelling around the UK. Ted Tyson had transitioned from a flat deck style colony system to what is seen in Figure 7. The deciding factor for the farmer were largely being able to house more birds in the same shed, but he has since found that the production from the hens is better than he ever had before, and they lay better quality eggs for longer.



Figure 7: Ted Tyson's Farm – South York, UK, 2019

Figure 8 below shows how the whole floor area of the house is usable for the birds. This picture was taken under the whole system, where the birds come under here to dust bath and scratch.



Figure 8: Underneath the laying system. Ted Tyson's Farm – South York, UK, 2019.

2.3 Mobile Housing Options

Mobile houses are an option for a producer when the building of a shed for a large group of birds is not desirable. Nutrient management on the range area for a free range egg producer is a challenging and very necessary consideration when selecting suitable housing to match the soil type, topography and climate.

To farmers, land is their most crucial asset, and the sustainability of the proposed operation must come before any other decision. Having the option of mobile housing means egg layers can be sustainably kept on land in a rotational basis without seeing degradation to the soil health.

Choosing the right mobile house for the land can be simplified into two categories:

- 'Wheeled' and therefore very mobile; or
- 'Skid mounted' and less mobile.

There can be a range of deciding factors that may play into this, but it should be noted that modern well designed and finished mobile housing systems can be quite effective. The days of converting a bus or caravan are hopefully behind the industry. Examples of poorly built and under equipped mobile houses are available throughout Australia, many of which do not have lighting provisions, which severely limits the output of eggs from the hens.

Only two examples of mobile housing options for free range egg production will be discussed here, for two reasons:

1. **Scale** is important to keeping the eggs affordable to the consumer so this report will not investigate equipment that is designed for less than 1,000 birds.
2. **Automation** is key to keeping the labour cost down, so the equipment must be computerised. Further to this point, many of the smaller mobile houses have very limited power options and therefore computer control and telemetry is unlikely.

2.3.1 Wheeled mobile house



Figure 9: Natura Caravan, produced by Big Dutchman. Source: Big Dutchman

Figure 9 show a “Natura Caravan” from the manufacturer Big Dutchman. When being used for free range eggs, this mobile (wheel mounted) house suits 1,200 birds. It also requires a connection to water and power. Inside the caravan is a full solid floor for dust bathing and a multi-tier aviary to look after the laying equipment. All feed and water are automated (Big Dutchman, 2019). These systems are becoming more popular in Europe as they are a simple diversification for the arable or dairy farmer who is thinking about eggs.

During a meeting with Alexander Neumann (Global Support for Egg Business Unit) from Big Dutchman, he shared his opinion that these houses suit very specific customer types:

- They must have a direct customer market link to make the required returns.
- They need to be within 100km of a very large town or bigger to get the customer to the farm.
- The ground must be flat and very free draining.
- They need to sell the eggs for a minimum of €5 per 10 eggs (at the time of writing that is over AU\$9/Doz).

Alexander went on to explain the additional labour requirements involved with these systems not normally associated with a traditional shed. If there are predators, the fences need moving regularly, and birds can also lay eggs under the house - these ‘dirty eggs’ cannot be sold within the European retail market.



Figure 10: Skid Mounted Mobile House. Source: Big Dutchman

2.3.2 Skid mounted mobile house

An alternative option to the towable (wheel mounted) laying house is a skid mounted house that literally slides on the ground (Figure 10). This eliminates the issue of birds going under the laying house and mislaid eggs. These systems can be wider, as they are not designed to be

regularly going through gateways and down farm roads. More importantly these systems have a lower capital cost, as there is not the additional engineering required with wheels, axles and tow hitches. A downside of this design is the need for very level, free draining ground. They are also less likely to be moved on as regular of a basis as their wheel mounted cousins due to their design. The movement of these styles of sheds is an important point that should not be overlooked but is not a main focus of this report.

So, which is better?

The housing systems detailed above all have their own positives, and there is clearly a business model for all of them in the right area as all three function quite well in different global markets. Condensing the considerations as much as possible comes back to these four factors:

1. **Stage of business growth** – Ranging from a new start business with no egg market to an extensive operation looking to expand.
2. **Area and type of land** – Are there extensive hectares available that could use polycultures to diversify, or is it a small plot in a wet area with steep terrain?
3. **Local egg market demand** – Boutique small scale tourism or low-cost commodity customers.
4. **Bird wellbeing** – Relevant to everyone!

Throughout the last 70 years of large scale egg production there has been cycles of progress within the industry striving for a dichotomy of better production and therefore more profitability or improved bird welfare and (assumed) increased costs. The introduction of cages was not done to simply make the life of the farmer easier; it was done to improve bird welfare. The knock-on effect was better production, lower mortality and improved health for the birds. The cages were introduced to deal with the fact that hens have an incredibly strong social hierarchy which is enforced without mercy. The optics of the production system unfortunately were not portrayed well, and it is a production system that appears to be leaving the Australian market. The industry must learn from the example of the cages, both current and past.

If the benefits of future housing systems are not explained properly to the consumer and they are left to draw their own conclusions for the equipment choice, they will likely come to perceived reasons based on first impressions and uneducated opinions. This is not the fault of the consumer, nor is it their job to go looking for the facts among the fiction in the online space. It is the job of all egg farmers to interact with the public about the facts of housing systems and equipment. Farmers must decide on a production method that suits their market and a system that meets their welfare philosophy, while still delivering what the consumer expects.

Chapter 3: Market Trends

3.1 Australia

In Australia, the choices being made about the types of eggs available to the consumers are primarily driven by the supermarkets, not the consumers themselves. The big two supermarkets in Australia (Coles and Woolworths) have both made pledges to only stock cage free eggs by 2025. This has been quietly pushed back several times over the last three years due to the continued consumer demand for caged eggs and the lack of cage free production to replace caged eggs with. In the last two years however there has been significant growth in the cage free egg market (Figure 11) (Australian Eggs, 2019a). This “lag time” may be due to many things but most likely stems from the farmer’s uncertainty with large capital investments and long planning and approval processes to get through in Australia.

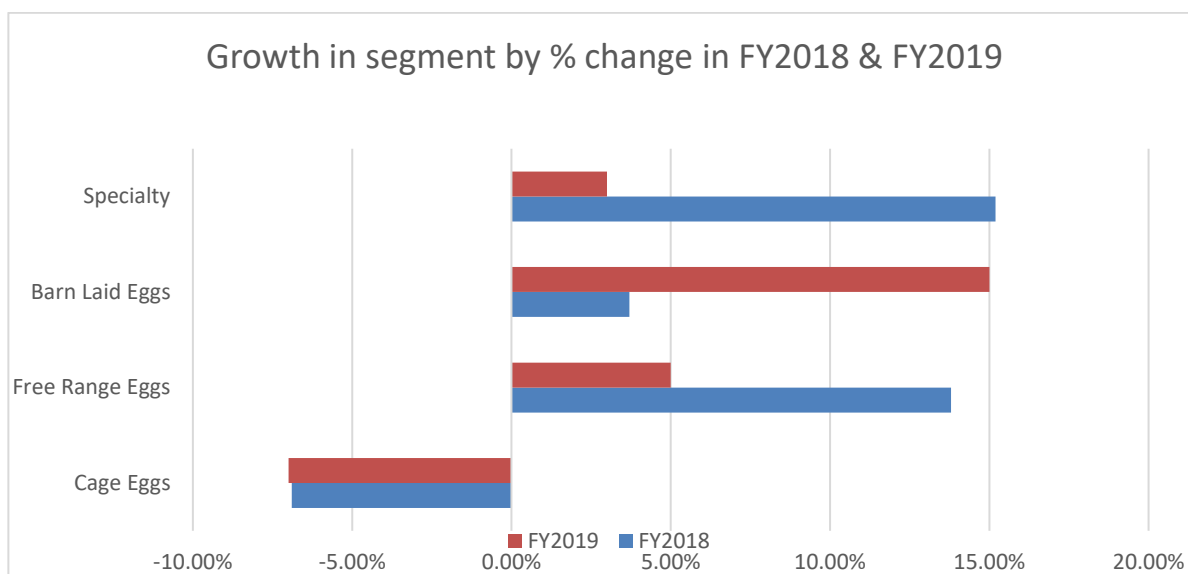


Figure 11: Growth in egg production method in Australia, 2018 & 2019, Australian Eggs

Figure 11 illustrates the difference between 2018 and 2019 production growth areas, with a significant downturn in growth from free range production to barn production. Over this period Australian free range egg producers have seen a saturation of the egg market with downward pressure on prices. It must also be noted that the major growth in the speciality sector still has little effect on the overall egg market at only 2% market share (Australian Eggs, 2019a).

Figure 12 below shows retail egg sales volumes for each production method. It illustrates how consumers in Australia are still supporting caged eggs, and therefore lower cost production methods.

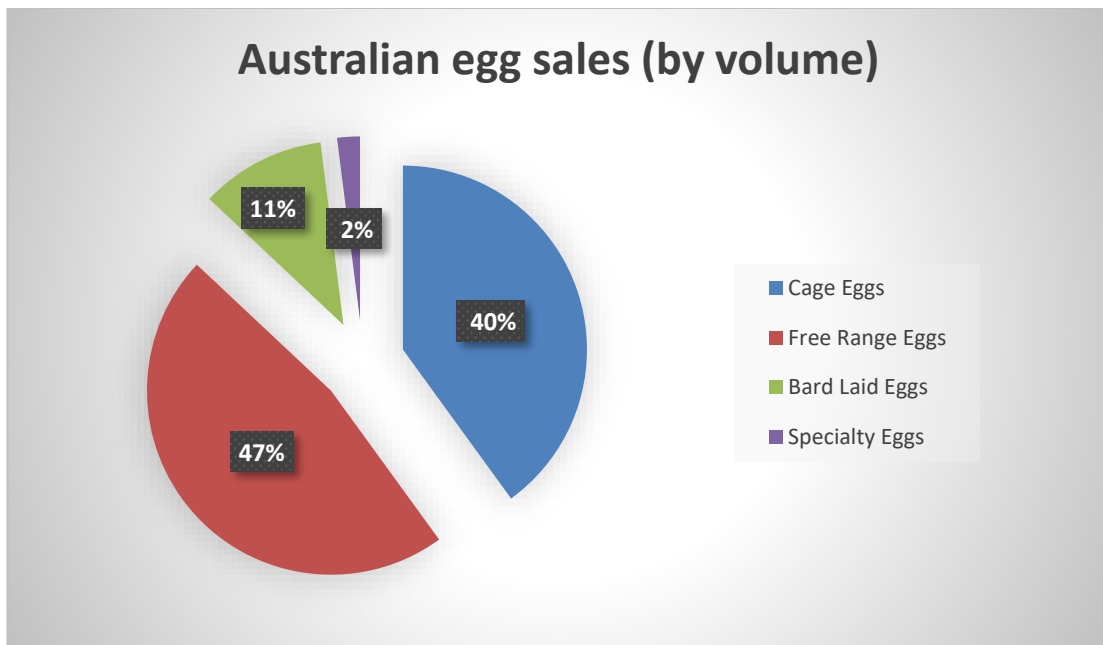


Figure 12: Australian egg sales by volume in 2018 and 2019 (Australian Eggs, 2019a)

3.2 Internationally

3.2.1 USA

The majority of hens in the USA are housed in conventional cage environments (Figure 13), although that is decreasing as some egg producers, retailers, food service providers and food manufacturers transition to cage-free eggs. In 2018, nearly 18% of all hens were in cage-free production, up from 12% in 2016 and 4% in 2010 (USDA, n.d.). According to USDA's Agricultural Marketing Service (2020) approximately 71% of USA hens must be in cage-free production by 2026 to meet projected demand.

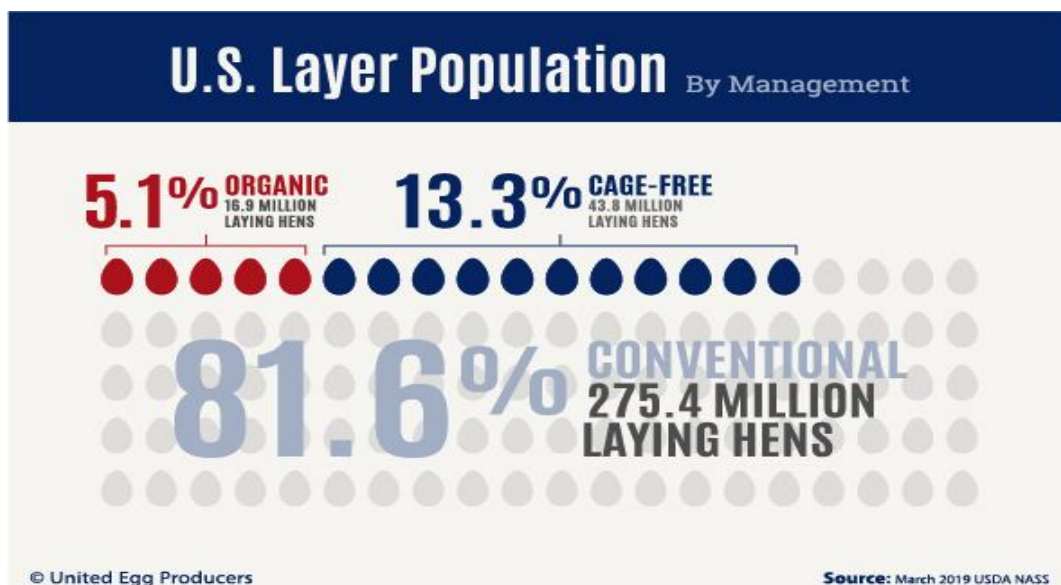


Figure 13: USA production system breakdown, United Egg Producers

When speaking to one of the larger equipment manufacturers from Europe they described the rush in the USA to move away from caged production as more panic than anything else, with little planning or research going into these very long term decisions. It is likely that bird welfare outcomes will be worse than the original cages.

3.2.2 UK

Data for the UK indicates there is a massive growth and demand for alternative production systems. Traditional cages are banned but enriched cages (a much larger cage with a scratch area and often a laying area with curtains) are still an important part of the production mix. Figure 14 below shows clearly how there is still a strong demand for enriched cage eggs while the free range egg market explodes (DEFRA, 2020).

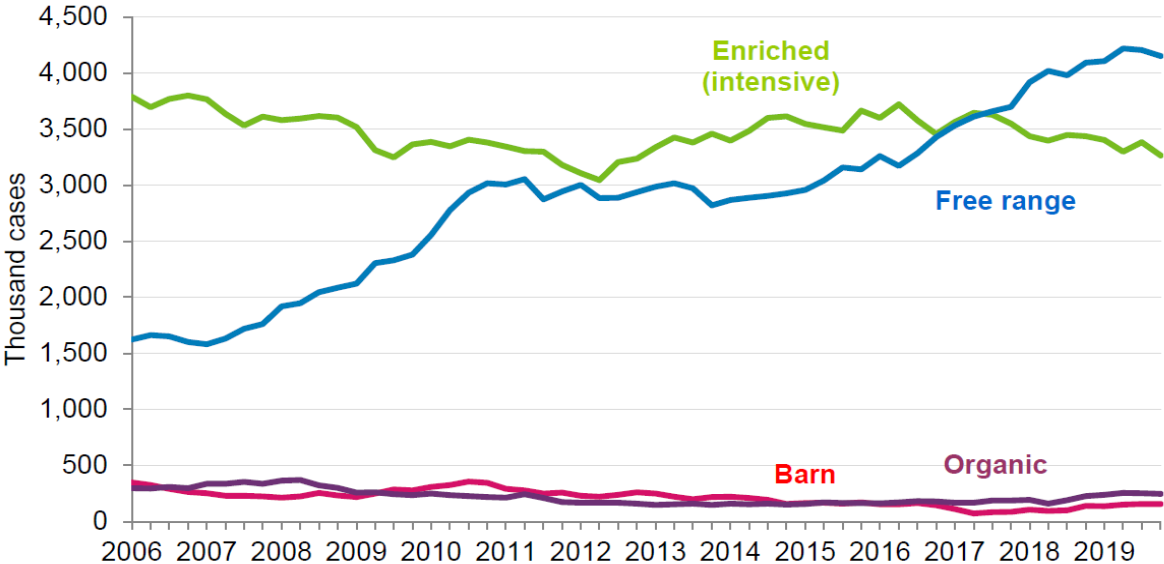


Figure 14: UK egg market trend data (Key: 1 cage of eggs = 360 eggs), DEFRA

While this data shows a clear trend towards cage free production methods it gives very little information regarding the specific type of cage free system used. The author has reached out to several of the suppliers to get further detailed information regarding systems installed in markets but nothing was forthcoming. One farmer the author spoke to in Germany stated that the systems being installed in his area looked very different to the ones he had seen in the UK. The systems are being built around the requirements laid out by governing bodies like Freedom Foods or the RSPCA, and this can be quite specific to each market and country.

3.2.3 China

China’s chicken egg industry is staggering, totalling 428 billion eggs per year. In 2016, they produced more eggs than the combined production of the USA, India, Mexico, Japan, Russia, Indonesia, Iran, Turkey, France and Ukraine. These are the next ten countries (in order) in the world ranking of egg production (Guyonnet, 2019). China’s eggs were once produced on small family farms throughout the country. In 2016 the average flock size was reported to be 5,450 hens. However, in 2020 this is expected to have increased up to 50,000 hens per farm.

On travels through China, the author saw eggs sold in every food market attended, almost always in bulk, un-washed and often un-graded packaging (Figure 15). They were relatively cheap but on par with Australian pricing. Unfortunately, when travelling through China, and with subsequent research, accurate information or even up to date pictures are hard to come by or not reliable.



Figure 15: Example of eggs in Chinese market. Source: author)

3.3 Summary of Foreign Markets

- Globally there is strong growth in alternatives to caged production.
- Local markets dictate varying production methods.
- Price of eggs drives decisions around economies of production.
- Tailored systems for local demand/local standards.
- Less developed economies are moving to cage free production methods.

Chapter 4: What is the Right Choice?

From the findings thus far, there are some factors to consider when thinking about investment into free range egg production:

- Who is the customer?
- What can the customer regularly afford?
- How many eggs can the market handle without negative price pressure?

These three questions should assist in the decision-making process as to the type of production system required. Knowing that 40% of retail eggs sold are at the lowest price point possible (cage production), identifies there is still strong demand for cheaper eggs, so is it wise to produce expensive eggs? The alternative would be to produce a higher welfare egg in a cage free/free range system, making sure this system is as productive and efficient as possible to keep the fixed costs down and therefore making the eggs more affordable. Pricing throughout Europe for cage-free eggs was variable, and in many cities relatively expensive compared to Australian pricing. It would appear from the authors experience, the cost of the eggs and welfare standards went up the more urban the environment, especially in Europe. In contrast, in the more rural areas, good quality high welfare eggs were for sale at farm gates or small stores for relatively good prices.

So, does the higher welfare standards and higher prices available in the cities reflect an expectation from the consumer that higher welfare simply must cost more? It can be argued that it does not need to, and modern aviary production systems can produce an excellent outcome for the chicken and the farmer while still producing an affordable product.

The demographic of the area will be very important to the producer if they are expecting to be selling most of their eggs locally. Customers buying habits within the region are not simply going to change because a producer has installed a mobile chicken house for eggs. Friends and family may buy into the product, however educating the wider community and asking them to part with more money is a great deal harder task.

4.1 Volume and Scale

One of the hardest questions faced by the would-be egg producer is either how to get started, or the rate of growth. Developing a market from zero is very difficult – selling a few eggs per week is easy, but selling every egg is another challenge. Then, the question of starting size needs to be asked, after all, it needs to be viable. Costing time and the costs that go into producing and packing eggs would be a subject large enough for another paper but there are some key areas to consider.

Capital one-off costs can be spread across as large an operation as desired, such as connecting to power, planning applications, engineering and possibly land. These will vary somewhat with size, but all will need to be paid. The expenses that grow with scale are the ones that really

need close attention. Pullet costs, feed costs, manure sales or disposal (depending on country). The more birds that any of these numbers can be divided by and therefore eggs produced, the lower cost per bird housed.

With equipment costs, these can be simplified into three:

1. All equipment mentioned is of the automated type so there are going to be drive motors, water regulators and environmental controls.
2. For the physical nesting and perching equipment, all will have two ends and a middle. The ends are expensive so the longer the equipment, the more efficient the use of associated motors and mechanics is.
3. "Standard" house lengths is the longest a single run of equipment can be without running into trouble with mechanical failures or other engineering considerations. The grower would then simply multiply these rows as necessary to suit their operation.

The major problem with aviary style laying equipment for the smaller producer (under 10,000 birds) is scale. A single row of the modern style aviary equipment can easily accommodate 10,000 birds on its own. Single row systems are less than desirable because it is not an efficient use of the shed space and would not provide for the bird to fly from one row to another to get down from the system (they would have to fly directly to the floor). Some advice the author was given from a large manufacturer is that they simply do not have customers for their aviary equipment that are under 20,000 birds. *"It is too costly per bird housed at the smaller scale"*. This begs the question: How, if the farmer wants the "best" equipment for the free range laying flock, can they either start out or grow by numbers below 20,000 birds? The farmer is restricted to installing yesterday's technology to grow by anything smaller.

One option is working with an integrator or egg packing company. In this instance budgets and contracts would be drawn up between the two parties and scale for the farmer can be achieved overnight. Many of these large packing companies have contracts with the major supermarkets. They also have forecast projections on demand which helps them develop extra capacity in production. With the correct planning and timing, they achieve a continued supply nationwide without saturating the market and selling everything they produce. This is how much of the global industry has grown over the past 50 years. The risk of sales and marketing is passed onto the large packing company with the sacrifice of margin for the farmer.

When travelling through Germany and the Netherlands, the author only came across one commercial scale farm (of Ewald van der Kamp in Nordhorn) that sold all their own eggs. They had a large range of market options and good relationships with their local supermarkets who took the eggs directly from the farm. They also had a very successful "pick your own" egg shed on the boundary of the farm for drive by consumer sales. This is very profitable for them and moves a surprising number of eggs thanks largely due to the local town and small distances between markets in Europe.

The three variations of growth outlined above each have their pros and cons, but the country of production is more likely to be the driving factor in the choice made. In Australia, it is a relatively simple process to pass the third-party auditing process to be accepted as a supplier to the major supermarkets. In the UK on the other hand, attaining a “British Lion Code” approved status is an incredibly hard process to go through and would likely require the help of consultants or a large egg packing company, thus hampering the small farmer’s ability to get into these retailers and therefore their ability to grow exponentially.

Conclusion

Housing systems for birds need to be thought about from a bird's perspective. Laying hens are kept in laying houses for a relatively long time so it needs to be considered home for them. The farmer should come second in this decision.

Great leaps are being made with multi-tier aviary systems throughout Europe, mainly being driven by legislation, but any developments towards improved bird wellbeing are a good thing. The Australian egg farmer should be looking to these learnings to be one step ahead of legislative changes that are probably inevitable in this country. Many of the changes are simple. Having improved perching for the birds and presented in a layout that is familiar to the hen will only make them more comfortable and therefore more productive.

Large-scale free range egg producers in Australia are already aware of new developments in aviary laying systems but getting these improvements in the housing system to the smaller scale farmer is going to be difficult and unlikely to be cost effective. The single biggest hurdle is the availability of aviary reared pullets that are available to the small/medium scale producer. Floor reared birds simply will not function in an aviary as they have not been trained during the rearing period to utilise the system effectively. Learning to jump and fly must be taught from a young age. Trying to learn this while going through the stressful period of learning to lay an egg will result in poor outcomes for all parties involved.

Locally produced food is likely to become more and more popular, especially in a post-COVID world. Developing a local market will be the cheapest way to get product to the consumer. Bypassing supermarkets will keep margins up while keeping eggs affordable. Consumers increasingly want to see how and where their food is made. Can it be possible for this interaction to occur on-farm safely with current biosecurity requirements? If not, how can the farmer design their farm layout differently, so the production area is not entered while still giving the consumer the interaction they want? An example like this was seen by the author in the Netherlands as part of the research.

Recommendations

- Find a source of aviary reared pullets or start working with the pullet rearer to consider the options for aviary rearing. Better yet, is there scope to rear your own birds?
- Whether it is barn or free range production, aviary style systems are more efficient than floor based housing methods. Consider what would be required to make the transition to modern multi-tier laying equipment.
- Look at as many systems as possible in a variety of different countries. There are so many options available to the farmer to suit local welfare requirements. Getting it wrong or not being aware of new legislation would be disastrous and incredibly expensive to fix after installation.
- If close to a potential or growing market, starting out small is an option and a great diversification for an existing enterprise.
- Do not consider putting floor reared birds into a multi-tier aviary.

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Plain English Compendium Summary

Project Title:	Future Housing Systems for Australian Free Range Egg Production
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Objectives	<ul style="list-style-type: none">• Look into trends of housing systems being installed globally.• Identify driving factors for the investment in a particular system.• Identify market drivers in different countries to see if they align with the Australian market.• Make recommendations for Australian farmers to consider which system might be best for their production, scale and market.
Background	This report was written and researched to gain an understanding of the direction of the free range egg industry globally with respect the future design of housing (or egg laying) systems.
Research	This report looks into the direction of housing systems for commercial scale free range egg production globally, visiting the USA, Singapore, Philippines, Hong Kong, China, Germany, The Netherlands, UK and Ireland. The diversity gained from the research has hopefully provided an ability to filter what might be appropriate in the current Australian market. The author has considered not only the economic benefits of the production system to the farmer but also any other driving factors which result in the choice of housing system. Bird welfare and consumer perception are going to be critical decision drivers.
Outcomes	Housing systems for birds need to be thought about from a bird's perspective. Laying hens are kept in laying houses for a relatively long time so it needs to be considered home for them. The farmer should come second in this decision. Scale is an inhibiting factor for the smaller independent producer to access the most up to date equipment. Modern housing system are synergistic with the birds natural behaviours and improve hen "happiness" and therefore egg production.
Implications	Smaller producers need to find a way to scale their business in a way that does not conflict with why their customers buy their eggs. Viability is difficult to achieve in the current egg market.
Publications	Nuffield Australia 2019 online presentation, available via YouTube here https://www.youtube.com/playlist?list=PLWdEyVDhYCck_Tz_pTG7nCVHa3fpO91p4 (March 2021)