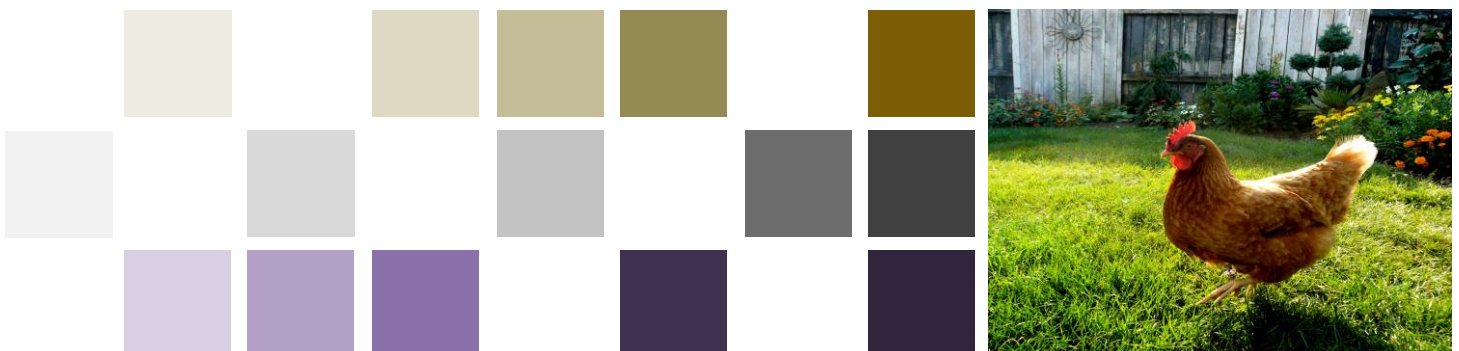


Sizing of the backyard and micro-commercial egg production in Australia

Australian Eggs

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October 2021



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Glossary

Abbreviation

ABS

ACT

Backyard producers

Micro-commercial producers

NSW

PIC

SA

VIC

WA

Stands for

Australian Bureau of Statistics

Australian Capital Territory

Defined as households raising less than 15 hens

Defined as households raising between 16 – 1,000 hens

New South Wales

Property Identification Code

South Australia

Victoria

Western Australia

Executive summary

While measurement of egg production from Australian commercial producers is currently captured, there is significant uncertainty on the level of production in the non-commercial segment of the egg industry. It is generally recognised that backyard and micro-commercial production (collectively referred to as the 'informal sector'), which are not captured in most conventional datasets for the egg industry, contribute to the total number of eggs consumed in Australia.

For several years, there has been a trend of increasing consumer preference towards free range and self-sufficiency that has led to an expansion of niche markets and the prevalence of households keeping hens. The COVID-19 pandemic appears to have accelerated this trend, as many consumers found their ability to purchase goods (including eggs) impacted by lockdowns and temporary shortages of supplies.

In this report, we developed a methodology and approach for estimating the informal sector. Backyard producers are defined as households raising less than 15 hens and whose level of production is typically driven to meet personal consumption demands, with additional eggs distributed to friends and family. In comparison, micro-commercial producers are defined as small-scale operations with up to 1,000 hens, whose level of production is substantially greater than observed in the backyard sector, but not to the same scale as larger commercial producers.

To undertake the modelling for this project, we undertook a desktop review of existing assessments of the informal sector and consulted with a range of industry stakeholders to collate best estimates of the potential size of the informal sector in each stakeholder's relevant market. While most stakeholders did not have a strong evidential basis for their estimate, most cited a general anecdotal figure of approximately 1 million birds in the backyard and micro-commercial sector, although this figure has been quoted as being used for many years. Historically, it was estimated that 10-15% of the national flock was outside the formal sector, which was estimated to be between 18-20 million. If 10% of this flock has remained to this day, then this would account for 1.8-2 million hens in the informal sector. A summary of the historical background is provided in 3.3 Appendix A.

Insight from these consultations formed the basis for the construction of a number of models, which we extrapolated to the national scale to produce Australia-wide estimates. The models we constructed estimate that the size of the backyard and micro-commercial market is between 1.2 - 3.8 million hens, which are estimated to produce between 174 - 591 million eggs – which would account for approximately between 3.0% - 8.6% of Australia's total egg production.

Based on the weighting assigned to each model, we derive a weighted average estimate of **2.2 million hens** in the backyard and micro-commercial market, which account for **28 million dozen eggs**. However, this production is not evenly spread across a calendar year with a significant weighting of production in the Spring months in which the increased sunlight and moderate temperatures create favourable conditions.

Of the 2.2 million hens identified, we estimate approximately 900,000 are in the backyard sector and approximately 130,000 are in the micro-commercial sector. However, due to the uncertainty relating to the origin of these hens (i.e. whether these additional hens are from major hatcheries or from presently uncounted sources such as spent hens¹ or backyard breeding), we are unable to state whether this number is included in or additional to the current estimates of Australian egg production.

Model	No. of hens	No. of eggs	No. of dozens
Weighted average model	2,162,703	337,812,883	28,151,074

Although an element of our estimate is influenced by a significantly higher estimate produced from the model based on parameters from the Australian Eggs Sustainability Framework, we note that all our other models also estimate the flock size in the backyard and micro-commercial market exceeds 1 million birds. This suggests that there has likely been significant growth in the backyard and micro-commercial market from the point whenever this original estimate of 1 million birds was derived.

¹ Spent hens are commercial layer chickens who are past their optimal egg laying age and are no longer commercially viable. In the Australian egg industry, this typically refers to commercial layers older than 76 weeks in age. Spent hens are sometimes sold to the backyard or micro-commercial sectors and will continue to lay eggs, albeit with lower productivity and life expectancy.

1. Introduction

1.1 Background

For several years, there has been a trend of increasing consumer preference towards free range and self-sufficiency that has led to an expansion of niche markets and the prevalence of households keeping hens. While large commercial eggs producers continue to comprise the significant majority the industry, the level of egg production through backyard and micro-commercial producers (collectively the 'informal sector') is increasing.

The COVID-19 pandemic accelerated this trend, as many consumers found their ability to purchase goods (including eggs) impacted by lockdowns and temporary shortages of supplies. The uncertainty around access to necessities coupled with the existing trend towards self-sufficiency reportedly led to a significantly increase in the demand for egg laying hens.

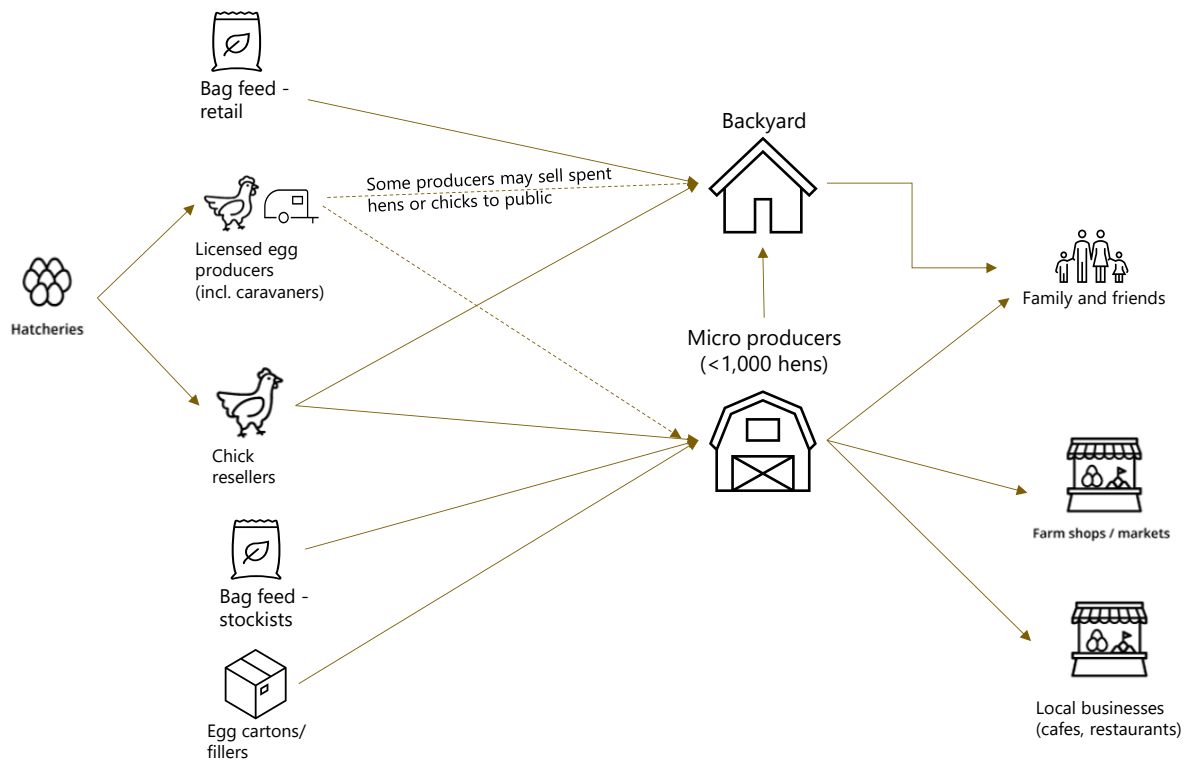
However, the earliest acknowledgement of the informal sector dates back to the early 1970s. Throughout, the 50s, 60s and early 70s the Industry was characterised by boom-and-bust cycles, which had a detrimental impact on the Industry. During his period, poultry farms tended to be smaller in size but more numerous. Additionally, poultry farmers were becoming more efficient at egg production, through the widespread implementation of scientific practices. This resulted in a shortfall of eggs in autumn and winter, and then a flush of eggs in the spring and summer months. In response, a quota system relating to hen licensing was introduced in the early 1970s. The quota system allowed Egg Marketing Boards to reduce production by 10% - 15% in spring and increase production in autumn by a similar amount. We heard anecdotally that the 10% increase/decrease, in today's birds numbers, would equate to approximately 2 million hens in the informal sector.

In this report, the informal sector incorporates both backyard and micro-commercial producers (Figure 1). We have defined backyard producers as households raising less than 15 hens² and whose level of production is typically driven to meet personal consumption demands, with additional eggs distributed to friends and family. In comparison, micro-commercial producers are defined as small-scale operations with up to 1,000 hens, whose level of production is substantially greater than observed in the backyard sector, but not to the same scale as larger commercial producers. Micro-commercial producers often include mixed farms in which egg production represents one of a range of economic activities.

State Regulation requires anyone who keeps or owns livestock (including poultry), over a certain threshold, to obtain a Property Identification Code (PIC). The threshold for poultry differs across each State, however, most States require a PIC for anyone keeping over 50 or over 100 poultry birds. For State Agriculture Departments, PICs are important for controlling detected disease and residue problems, as the Departments can use the PICs to trace and locate affected properties.

² There is no formal definition of backyard egg production, and we note that the threshold across different Local Government Areas in Australia can vary from between 5 to 50 hens before needing to apply for a license.

Figure 1 Supply chain of the backyard and micro-commercial sectors



1.2 Purpose of the project

While measurement of egg production from Australian commercial producers is currently captured, there is significant uncertainty surrounding the non-commercial segment of the egg industry. It is generally recognised that backyard and micro-commercial production, which are not captured in most conventional datasets for the egg industry, have an impact on the total number of eggs consumed and demanded in Australia, particularly over Spring and Summer, where these hens are most productive.

Australian Eggs is interesting in developing insights into the following:

- the structure and supply chain relating to backyard and micro-commercial egg production,
- the size of the backyard and micro-commercial sectors (the number of eggs and hens), and
- any market patterns and growth trends on the sector.

This project was completed in two stages. The first stage involved a targeted desktop review and consultations to develop an understanding of any prior analysis into the sector, and the general thinking on the sector amongst industry experts and stakeholders. The information obtained was used to undertake a market assessment, developing a Proof of Concept that the size of the non-commercial segment in Australia could be estimated. Stage two involved finalising a series of different models that used different data sources to calculate a range of estimates on the number of hens and eggs produced in this segment of the egg industry.

2. Approach and methodology

The following section outlines the key steps utilised by Sapere to undertake the analysis for this report.

2.1 Desktop review

Initially, a targeted desktop review on the range of information and data available in relation to the micro-commercial and backyard egg production in Australia and internationally was undertaken. Additionally, we investigated whether any literature that discussed methods that had previously been used to quantify production in these sectors in other jurisdictions. The available material we reviewed includes:

- commercial production (Australian Eggs data)
- egg consumption estimates (e.g., Omni Poll)
- government agency research and data (e.g. ABS, CSIRO, agriculture sector reports)
- local authority information (including regulations, permits, and data on property identification codes)
- egg industry suppliers and any publicly available sales data
- IBISWorld market analysis and data
- economic literature on the backyard sector.

The findings from our desktop review suggests that there is limited research and quantification on backyard and small-scale egg production. In the majority of cases where quantification was undertaken, this typically involved in-person surveys at retail pet supply stores³. Some difficulties that constrained this type of analysis included but are not limited to:

- the ability to collect representative datasets leading to limitations in the data
- difficulty in identifying and targeting participants in this segment of the market
- confidentiality concerns regarding farm and business information
- regional and environment-specific contexts that made comparison of egg production across jurisdictions difficult.

2.2 Consultations

As part of this process, we interviewed 12 individuals across the egg industry, initially using contacts provided by Australian Eggs, but expanded to include more leads provided by stakeholders. The individuals we interviewed included:

³ C. Elkhoraibi, R. A. Blatchford, M. E. Pitesky, and J. A. Mench (2014). Backyard chickens in the United States: A survey of flock owners. Retrieved from <https://doi.org/10.3382/ps.2014-04154>

- egg producers and wholesalers
- chick growers and (re)sellers
- egg industry product suppliers (i.e. stockfeed) and service providers
- agricultural departments of state governments.

Stakeholders were engaged via videoconference and telephone calls, with follow-up emails sent if additional information or clarification was sought.

In general, interviewed stakeholders agreed there isn't a good understanding of the size of either the backyard or micro-commercial segment and the relative limitations of data that could be used to develop an estimate of the size of the market. However, several stakeholders did provide their best estimates of the potential scale of the sector, as well as discussing potential proxies that could be extrapolated to quantify the different segments of the sector.

2.3 Market assessment

The insights and data obtained throughout the desktop review and consultations, provided the basis to undertake a market assessment of the size, production and trends in the backyard and micro-commercial sector.

More detail is provided in the subsequent chapters and appendix on the methodologies used to estimate micro-commercial and backyard production. However, a high-level analysis of the inputs that were used in development our range of estimates includes:

- analysis of national survey data collected as part of Australian Eggs Sustainability Framework
- engaging with egg industry stakeholders and experts to gather data and develop proxies for estimating flock size and production levels
- consultations with suppliers including small layer chicken suppliers, small layer chicken breeders, bagged feed suppliers, and/or chicken coop suppliers (as input into developing proxies for estimating flock size)
- consultation and review of any available local and state government authority information (including rules on numbers of chickens allowed in residential areas) and explore any available empirical data on permits etc.

Based on these inputs, we developed several models that use a number of proxies that we extrapolated to develop estimate the size of the backyard and micro-commercial hen flock.

2.4 Calculate weighted summary of hens and productions

Based on the number of assumptions and quality of data inputs into each model, we assigned a weighting to each model to derive a single weighted average estimate of the number of hens and the number of eggs in the total Australian backyard and micro-commercial sector.

3. Findings

3.1 Estimates of size and production of the backyard and micro-commercial market

The models we constructed estimate that the size of the backyard and micro-commercial market is between 1.2 - 3.8 million hens, which are estimated to produce between 174 - 591 million eggs – which would account for approximately between 3.0% - 8.6% of Australia’s total egg production.

Based on the weighting assigned to each model, we derive a weighted average estimate of **2.2 million hens** in the backyard and micro-commercial market, which account for **28 million dozen eggs**. Of these 2.2 million hens, we estimate approximately 900,000 are in the backyard sector and approximately 130,000 are in the micro-commercial sector.

However, due to the uncertainty relating to the origin of these hens (i.e. whether these additional hens are from major hatcheries or from presently uncounted sources such as spent hens or backyard breeding), we are unable to state whether this number is included in or additional to the current estimates of Australian egg production.

Table 2 summarises the estimates derived for each of our models. Details are provided in 3.3 Appendix B Appendix B on the steps used to derive these estimates.

Table 2: Estimated size and production of the backyard and micro-commercial market

Model	No. of hens	No. of eggs	No. of dozens	Model weighting
Feed volumes – WA chick reseller	1,387,868	219,381,551	18,281,796	10%
Feed volumes – National feed manufacturer	1,373,110	250,592,593	20,882,716	10%
Chick orders - WA chick reseller	1,248,198	195,525,062	17,046,748	10%
Chick orders - SA chick reseller	1,596,114	236,563,485	19,713,624	10%
Golden Plains Shire count - VIC	1,834,082	287,301,356	23,941,780	10%
Distribution modelling - VIC	1,583,779	248,092,415	20,674,368	10%
Sustainability framework	3,773,719	591,137,387	49,261,449	30%
OmniPoll consumption model	1,282,721	202,760,821	16,896,735	10%
Weighted average model	2,162,703	337,812,883	28,151,073	100%

3.2 Discussion of results

3.2.1 On our results

Our results suggest a significantly larger backyard and micro-commercial sector than the previously cited figure. While most stakeholders did not have a strong evidential basis for their estimate, most cited a general figure of approximately 1 million birds in the backyard and micro-commercial sector, although this figure has been quoted as being used for many years.

Although an element of our estimate is influenced by a significantly higher estimate produced from the model based on parameters from the Australian Eggs Sustainability Framework, we note that all our other models also estimate the flock size in the backyard and micro-commercial market exceeds 1 million birds. This suggests that there has likely been significant growth in the backyard and micro-commercial market from the point whenever this original estimate was derived. It is also important to note that our model does not take into account any element of seasonality, and it is the number of birds that are laying over spring and summer that will have the biggest impact on overall egg volumes.

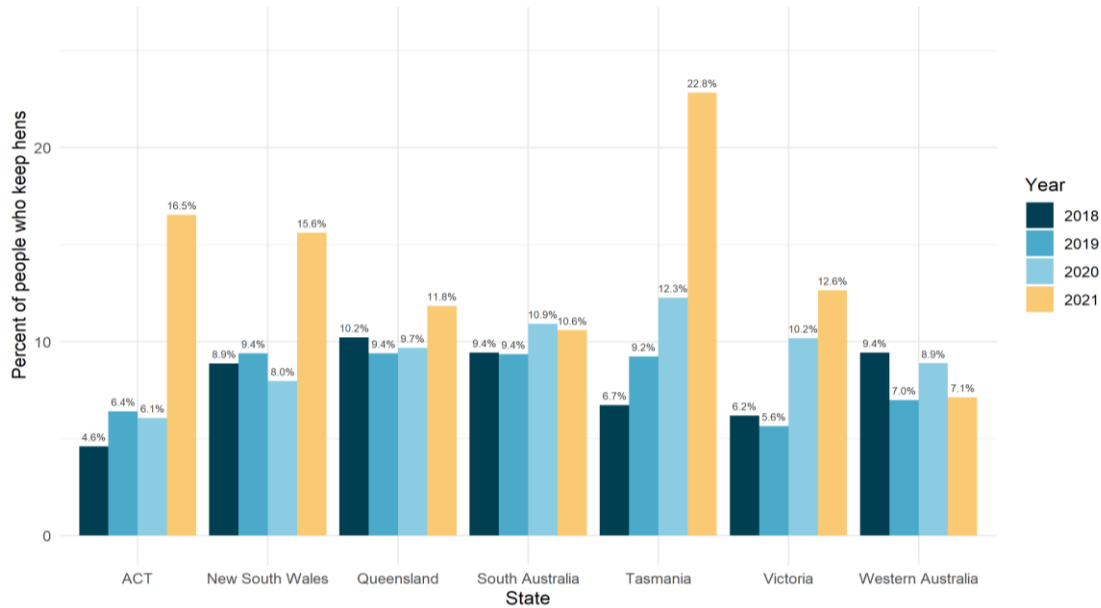
Our figures represent best estimates primarily based on data collated from industry stakeholders. They use extrapolations of region and state level rates to a national level, and rely on a number of assumptions across each model. We discuss some of the limitations of our approach at the end of this chapter.

In the next sections, we discuss some of the potential drivers of this trend based on what we heard in our consultations and our assessment of the available data.

3.2.2 Increased trend towards household self-sufficiency

An increasing trend of households becoming more self-sufficient, accelerated by the COVID-19 pandemic, is one of the potential factors that could factor into the significant growth in the non-commercial market. Throughout our consultations, individuals cited consumers concerns about the ability to purchase eggs during the various lockdowns and following runs on supermarket supplies. This panic purchasing created a perception that there was a risk of a shortage of eggs being available in Australia, which led to some individuals to believe they needed to purchase their own hens to ensure supply of eggs. The findings in the Australian Eggs Sustainability Framework Report 2021 support this trend, as the reported number of people keeping hens significantly increased during 2020/21 across all states. Figure 2 illustrates the reported percentage of individuals who kept hens (by state).

Figure 2: Proportion of surveyed individuals that kept hens

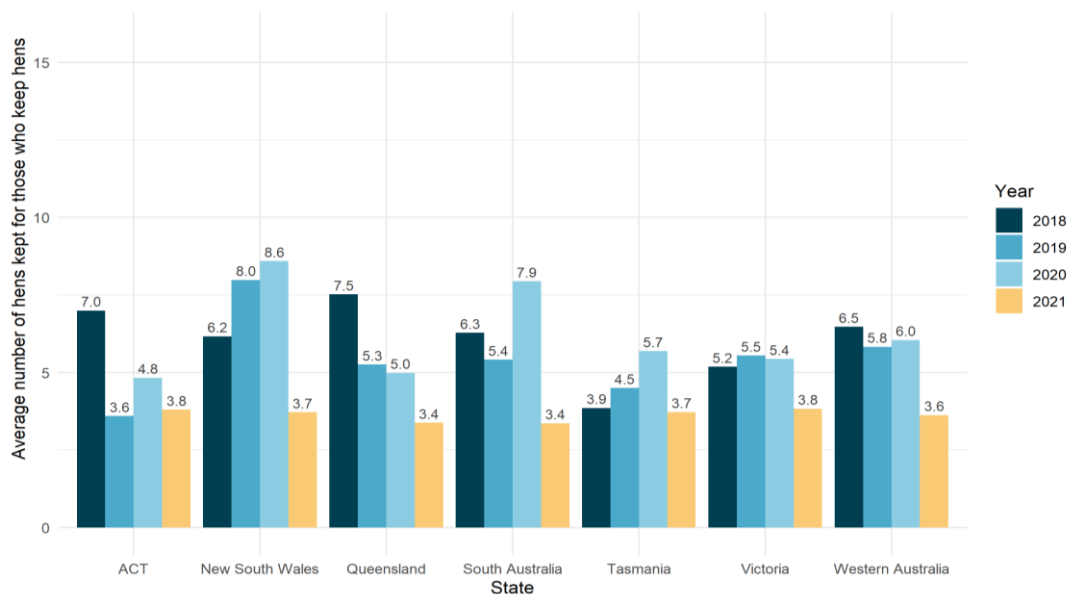


Source: Data from the Australian Eggs Sustainability Framework Report 2021 provided to Sapere

Figure 3 illustrates the average number of hens kept by individuals who keep hens. It is evident, that for most states, the average number of birds kept, increased during 2020. Whilst the average significantly fell in 2021, if Figure 2 and Figure 3 are analysed together, this suggests there was a significant increase in the number of households keeping a small number of hens, which in turn resulted in lower average figures.

One important factor to note in these results is that the questions asked in the survey relate to the number of hens kept without specifying whether these hens are layers. It is possible that the respondents who keep hens may include those who keep hens for non-egg laying purposes such as fancy fowls, in which case, these figures would represent overestimates of backyard egg production.

Figure 3: Average number of hens kept by those who keep hens



Source: Data from the Australian Eggs Sustainability Framework Report 2021 provided to Sapere

3.2.3 Sale of spent hens to backyard producers

Another aspect of the market that was discussed in our consultations is the existence of a secondary market where spent hens are sold to backyard producers. Spent hens are commercial layer chickens who have past their optimal egg laying age and are no longer commercially viable. In the Australian egg industry, this typically refers to commercial layers older than 76 weeks in age. This introduces hens into the system with lower productivity and life expectancy. Stakeholders suggested that the recent uptick in demand for backyard hens has resulted in spent hens being sold by producers to recuperate costs as an alternative to mass disposal of hens. Our consultations reported that some producers were selling spent layer hens for between \$20 and \$80 each hen during the peak pandemic demand periods.

In recent years, the cost of culling birds has become an issue for some farmers, with the lower price provided from hen disposal creating an incentive to dispose of birds through informal channels. Lower prices for the meat of spent hens and its limited uses (mainly used for fertiliser and composting) have resulted in a situation where farmers now pay approximately 25 cents per culled hen. As a result, we have heard that some small-scale producers have instead resorted to selling spent hens through informal channels, rather than disposing of the hens through commercial disposal services.

However, while we heard anecdotal evidence of this practice occurring, there was limited data on which we could evaluate the extent of this practice. As such, it is difficult to estimate the size and impact of the secondary market that this sale of spent hens creates – although our consultations suggested that hundreds of thousands of spent hens are entering the backyard market through this channel. There were also separate issues relating to biosecurity on these farms that arose as a result of this practice.

3.3 Potential limitations to the modelled estimate

There are some potential limitations to this modelling that are relevant to consider. As further investigation or analysis of the sector takes place, it is possible that some of these current limitations may be able to be addressed in future updates to the current model used for this market estimate.

Estimates based on extrapolation: To arrive at our final estimates, each model typically had to extrapolate the number of hens in a small region and then extrapolate this number to derive a national estimate based on a per capita or per household ratio. This approach means that elements such as variability between different states, regions and household types are typically not able to be incorporated into the modelling, which may lead to an over- or under-scaling of the figure when it is applied.

Limited dataset: While we collated data from a number of industry stakeholders who were forthcoming and provided their best estimates on figures where available, our dataset relies on a number of key figures that form the basis for our extrapolations. While we have no reason to believe these figures are inaccurate, it is important to note that the results of our extrapolations will be dependent on the initial data points which we have employed.

Assumptions for some key estimates: There are some key assumptions which are required for each our models, such as the proportion of total eggs contributed by the backyard sector compared to the

micro-commercial sector. While we have tested these figures with industry experts, it is nonetheless important to highlight that these figures represent best estimate assumptions rather than quantitatively derived values. We detail these assumptions in Table 3 in 3.3Appendix B.

Unquantified elements of the market: As there was limited data and prior research on the size of the backyard and micro-commercial sectors, there are several gaps in our knowledge which could not be quantified for this model. This includes elements such as the proportion of spent hens that are sold into the secondary market and any non-commercial breeding and sale of chicks that occurs. Our lack of insight into this sector is also the reason why it is difficult for us to determine the proportion of our estimate that is counted in current egg production figures.

Limited number of comparators: The backyard and micro-commercial sector is poorly understood in most jurisdictions, and as such, there was little existing research to draw upon which could act as a comparison to case in Australia. This means we lack a 'sense check' of comparative jurisdictions to help guide the extent to which our figures may be accurate, although there are likely factors that would make the Australian backyard and micro-commercial market distinct in many ways.

References

Australia Bureau of Statistics (2021). National, state and territory population. Retrieved from <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release>

Australian Eggs (2021). Sustainability Framework Report 2021. Retrieved from <https://www.australianeggs.org.au/what-we-do/sustainable-production/sustainability-report>

C. Elkhoraibi, R. A. Blatchford, M. E. Pitesky, and J. A. Mench (2014). Backyard chickens in the United States: A survey of flock owners. Retrieved from <https://doi.org/10.3382/ps.2014-04154>

Statista (2019). Number of households in Australia from 2016 to 2041, by state. Retrieved from <https://www.statista.com/statistics/608977/australia-households-by-state/>

Appendix A Key insights from desktop review and consultations

The following bullet-points summarise the key information heard, and data provided throughout the consultations that informed the analysis in this report.

Relevant context for understanding Australian backyard egg production

- The evolution of egg production in Australia post-World War 2 was approximately 100,000 egg farmers, with each town and peri-urban area would have a proliferation of small egg farms. Transition from free range to cage system in the 1960s transformed the industry into its current form.
- In the 50s and 60s, the sector was characterised by boom-and-bust cycles – with a shortfall of eggs in autumn and winter – then a flush of eggs in spring and summer, which impacted the price. In response to this, in the 1970s, statutory marketing authorities were introduced which vested control of production to a marketing authority by state legislation
- Each authority was charged with supply management – which was done through licensing at a price of approximately \$15 a bird. If you had more than 50 hens, you needed a license
- Supply was managed by reducing the issuance of the license between 10-15% in the first week of Spring (early September). From September onward, producers would have to drop 15% hens through spring and summer, which would then be re-instated in February
- This was due to the impacts of the Spring Flush - chicken laying responds to day-length – longer day length results in more eggs. In contrast, people who keep backyard hens do so without artificial light – this leads to a shortfall in backyard production when compared to commercial producers
- Presently, the Spring Flush is roughly estimated to result in an additional 12% in egg production
- Housing 1,000 hens is the threshold for considering backyard eggs, mostly as an administrative construct, as this is the figure where matters such as vaccination requirements have traditionally been required and become important system issues

Prevalence of backyard and micro-commercial producers

- Interviewees agreed that the number of producers had significantly increased. Throughout our consultations the growing number of small producers seen at farmers market, on Facebook (and other websites), or just setting up a stall on their property.
- Interviewees thought that many of these smaller producers would be producing eggs in conjunction with other agriculture products – creating multiple sources of incomes. However, for micro-commercial producers at the top-end (~1000 hens), their egg production could generate a steady source of income, although at this scale it is unlikely to be sufficient to be a self-supporting enterprise
- One interviewee estimated that in the 1970s, 10-15% of the national flock was outside the formal sector – 18-20 million. If 10% of this flock remains, then this is about 1.8-2 million hens

- Ready to lay hens have become increasingly common in ad-hoc markets – anecdotally, prices went from \$20-30 to \$60 under the current environment
- To house up to 1,000 hens – would need to live in peri-urban or regional area, as you would need a bigger block than a city block, and would need to deal with issues such as buffering the odour of livestock – this would constrain the ability to house micro-commercial chickens to particular areas. You would also need discrete buildings like a shed, which would demand 100 sqm of building and 1000 sqm of land
- One interviewee suggested small producers have spiked up considerably in the past 5 years
- COVID has significantly impacted and driven up demand – but these are not sustainable – eggs were going off the shelf leading to consumers to believe there was a shortage of eggs
- There is a group that sells spent layer hens - \$20-\$80 each
- Some interviewees thought that while there is widespread anecdotal evidence of backyard and micro-commercial egg production, it is not clear that it has a huge impact on the commercial industry and might be overstated

Economics of the backyard and micro-commercial sectors

- The backyard segment is typically households who have 2-3 birds and are generally unconcerned about the production efficiency of the bird. These birds tend to live a lot longer (4-6 years), as they are viewed as a pet that produces food, and as such, if it is sick, it will typically be taken to the vet irrespective of cost
- The business model for the micro-commercial segment is typically a hobbyist who understands the baseline knowledge of poultry
- At 50-100 dozens a week, a producer is producing more eggs than would be needed a household level. This can be quite profitable as a supporting source of income – 40,000 dozens a year at \$6 a dozen would equal \$250,000 additional revenue a year
- Moreover, for up to 2,000 hens, the workload for managing the hens is enough for one person to manage on a part-time basis, with the rest of the part-time is spent on selling the eggs
- These sellers typically sell in a very micro footprint – most local buyers, sometimes at a market, and in the process, they build a local brand
- Issues arise when these growers try to scale that up and expand, as they need to bring on employees, expand their radius of sale, realise economies of scale etc...
- The impact of the backyard sector can sometimes be seen in changes in commercial egg demand in regional supermarkets, where many of these producers are located – the impact would be comparatively lower in metropolitan areas
- Spent hen have traditionally been sent to processors, but the meat is not very valuable and can't be exported. Mass destruction costs about 25c per hen and are usually sent for composting or a rendering plant. Timing at processing plants can also be a logistical issue and this creates disincentives to disposal of birds through this channel.
- Some producers are instead selling their spent hens to recuperate costs – rather than paying costs for mass destruction

Factors driving the increase in market size

- The COVID-19 Pandemic has significantly driven up demand. The perceived shortages of eggs encouraged an increasing proportion of consumers to become more self-sufficient. Most interviewees agree that the growth rate wouldn't be sustainable once the Pandemic subdued but did think the market size would remain constant in the short run. In the long run, consumer preferences would dictate its size.
 - The increase in the number of backyard and micro-commercial hens isn't the only agricultural industry to see a rise in the backyard ownership. One interviewee discussed that the trend towards self-sufficiency and knowing the origin of the product during COVID-19 had seen a rise in the number of sheep and pigs owned.
 - The lady campaign (sell a chicken or give them away), is just one of the public campaigns that generated a lot of media attention.
- The existence of a secondary market where caravaners and even some large commercial producers sell spent hens into the backyard market. Because of the increasing cost of mass culling and the logistical issues for caravaners, they have begun incorporating reselling their spent hens into their business model. At the height of COVID-19 demand, interviewees indicated that spent hens could sell for \$80 each. Some interviewees thought this secondary market could see the sale of hundreds of thousands of birds each year.
 - Most interviewees discussed the risks of this largely unregulated and unknown secondary market – biosecurity and immunisation. The sale and pickup of spent hens at properties has the potential to introduce biosecurity risks, that could impact consumer safety but also the surrounding network of egg producers. Furthermore, interviewees thought a large proportion of the producers in the backyard and micro-commercial segment would be hobbyists, therefore, wouldn't know where to go for immunisation or the initial indicators of an outbreak.

Appendix B Methodology used to calculate ranges

Sapere constructed several different models to calculate a range for the number of hens and eggs produced in the non-commercial segment of the egg industry. These models are based on consultations with industry stakeholders and data obtain from those stakeholders. To ensure consistency, a consensus between industry experts was reached regarding several parameters that are held constant throughout the models. Table 3 below set outs those parameters:

Table 3: Assumptions that are held constant throughout the models

Parameters	Figure
Proportion of eggs contributed by backyard birds	30 per cent
Proportion of eggs contributed by micro-commercial birds	70 per cent
Average productivity of backyard birds	120 eggs per year per bird (33 per cent)
Average productivity of micro-commercial birds	183 eggs per year per bird (50 per cent)
Average productivity of spent hens	110 eggs per year per bird (30 per cent)
Replacement rate of backyard and micro-commercial birds⁴	40 per cent
Total feed needed per bird per year	49.3 kgs (135 grams per day)
Total Australian population (as of 31st December 2020)⁵	25,694,393

Whilst multiple models have been constructed, the extrapolation of these figures into estimates for the number of birds largely draw from three sources:

- **Volume of stockfeed sales:** Assuming hens eat 135g of feed a day, we develop estimates of the total number of birds based on the total tonnage sold in a year and estimates of the

⁴ The replacement rate is the proportion of backyard and micro-commercial hens that need to be replaced each year due to mortality

⁵ <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/latest-release>

market size (obtained through interviews), which are then extrapolated based on the ratio of the market population to the Australian population

- **Hatchery numbers and chick orders:** Based on the number of chicks sold by resellers to a particular market and based on market sizing estimates, we estimate the number of birds for a given market, which are then extrapolated based on the ratio of the market population to the Australian population
- **Property Identification Codes (PIC) and distribution of birds:** We estimate the total number of households and reported number of hens in a given geography and extrapolate the ratio of hens per household to the total count of Australian households

The following sections illustrates the steps of each of the models constructed and used by Sapere.

Feed Volumes – WA

As backyard producers operate on a small scale, it assumed that their feed would be sourced from local pet stores and other agricultural retailers, rather than from wholesalers. Using the information provided to us by a stockfeed reseller in Western Australia, the steps for constructing this model were:

1. Each week, approximately 2 tonnes of feed was sold by the reseller. Converting this figure into total feed sold per year in Kilograms (kg), provides an estimate of 104,000kg of feed sold.
2. Assuming the total feed needed per bird per year is 49.3 kg, we estimated the implied number of hens fed by feed sold by this reseller – 2,111 hens.
3. We assumed this seller sells feed to approximately 5 per cent of the total market,⁶ which suggests the total number of hens in the market is 42,212.
4. Using Perth's 2020 population, we estimated the proportion of hens per 1,000 people. The number of hens per 1,000 people in Perth is 21.27.⁷
5. Extrapolating this figure to the total population of Australia, we estimate the total number of backyard hens across Australia is 546,405.
6. We assume the average productivity of backyard hens per day is 30 per cent. Therefore, the implied total number of eggs entering the backyard system in Australia each year is 65,814,465.⁸
1. Based on an assumption that the backyard system produces 30% of the eggs in the informal sector, we use the figure of 65,814,465 eggs to develop an equivalent estimate for the micro-commercial sector (assumed to produce 70% of the eggs) - 153,567,086 eggs⁹

⁶ The market share of 5 per cent was estimated by the reseller.

⁷ This figure is calculated by dividing the implied number of hens in the market (42,212) by Perth's population (1,985,000).

⁸ This figure is calculated by $546,405 * 0.3 * 365$

⁹ This figure is calculated by $65,814,465 / 0.3 * 0.7$

2. Based on the assumed productivity of hens in the micro-commercial sector, we use the figure of 153,567,086 eggs to develop an estimate of 841,463 hens in the micro-commercial sector in Australia.¹⁰
3. These figures are summed together to produce an estimate of the total number of hens of 1,387,868 and total number of eggs produced of 219,381,551.

Feed volumes – National feed manufacturer

Based on the total estimated volume of feed sold by a national chicken feed manufacturer in Australia, we undertook the following steps to develop an estimate of the total number of hens in Australia:

1. The total volume of feed sold per year by the feed manufacturer in Australia in 2019-20 was estimated to be 16,915,000 kg.¹¹
2. Assuming the total feed needed per bird per year is 49.3 kg, this implied the number of hens fed by this amount of feed is 343,278 hens.
3. The feed manufacturer was estimated to account for 25 per cent of the Australian feed market, which implies the total number of hens in the market is 1,373,110.
4. We calculate the proportion of this number of hens that must be backyard hens such that their production accounts for 30 per cent of total egg production in the informal sector, which is 572,129 hens¹².
5. We then use this figure to calculate the balance of the number of hens, which must be in the micro-commercial sector - 800,981
6. We apply the assumed productivity rates of the backyard and micro-commercial hens to derive the estimate of the total number of eggs produced
7. Using this method, the total number of hens is 1,373,100 and eggs produced is 215,091,975.

Chick orders – WA

Similar to the purchasing patterns of stockfeed by backyard producers, it is thought the majority of backyard hens are purchased through pet stores and resellers. Based on the information we obtained regarding the number of chicks sold by a reseller in Western Australia, the following model was constructed:

1. Approximately 27,000 day-old chicks were sold in a year to this reseller in WA, who was assumed to be the sole supplier of SBA chicks, who account for 70 per cent of the day-old chick market. Therefore, the estimated number of chicks sold in Perth each year is 38,571.

¹⁰ This figure is calculated by $153,567,086 * 0.5$

¹¹ Aggregated feed volume sale data for the feed manufacturer was provided by Australian Eggs.

¹² This figure is calculated by $1,373,110 * 0.5 / (0.5+0.7)$

2. Based on this figure, the estimated proportion of day-old chicks sold into the backyard market in Perth, per 1,000 people, is 19.43.
3. Extrapolating this figure across Australia population, we derive an estimate of 499,279 chicks were sold into the market in Australia.
4. An assumption is made that these chicks sold are to replace existing hens. Assuming the replacement rate of backyard and micro-commercial hens is 40 per cent, then the total number of hens is 1,248,198
5. We calculate the proportion of this number of hens that must be backyard hens such that their production accounts for 30 per cent of total egg production in the informal sector, which is 520,083 hens¹³.
6. We then use this figure to calculate the balance of the number of hens, which must be in the micro-commercial sector – 728,116
7. Using the proportion of eggs contributed and the productivity of backyard and micro-commercial hens, we calculate the total number of eggs produced by these hens
8. Using this method, the total number of hens is 1,248,198 and eggs produced is 195,525,062.

Chick orders – SA

Additional information was obtained regarding volumes of chick orders in South Australia from a reseller. This information was used to construct the following model:

9. Each year, the reseller estimated that approximately 10,000 day-old chicks were sold to a small proportion of pet and feed stores – the reseller estimated this was 30 per cent of the South Australian market.
10. This implies that the total South Australian market for day-old chicks is 40,000 chicks per year.
11. An assumption is made that these chicks sold are to replace existing hens. Assuming the replacement rate of backyard and micro-commercial hens is 40 per cent, then the total number of hens in South Australia is 100,000.
12. The reseller also estimated that approximately 10,000 spent hens were sold into the South Australian backyard market from chicken caravan businesses.
13. Combining these two figures together produces an overall South Australian market size for hens of 110,000 hens.
14. Based on the population of South Australia, we calculate the proportion of chicks and spent hens sold per 1,000 people in South Australia is 75.30 and 5.65 respectively.¹⁴

¹³ This figure is calculated by $1,373,110 * 0.5 / (0.5+0.7)$

¹⁴ The population of South Australia in 2020 was 1,770,790.

15. We then apply these proportions to Australia's total population, to arrive at the implied number of chicks and spent hens sold across Australia to be 1,934,684 and 145,101 respectively.
16. The total number of hens is 1,596,114 and eggs produced is 236,563,485.

Golden Plains Shire count - VIC

An avian influenza outbreak that occurred in Golden Plains Shire (Victoria) in 2018 provided an opportunity for Agriculture Victoria to collect more detailed information on the prevalence of poultry numbers across properties in the Shire. This information was provided to us in aggregate, including count of properties in the Shire with particular bird counts. Using this information, we constructed a model that extrapolated the distribution of poultry numbers to the whole of Australia. The steps used in building this model were as follows:

1. Identify the count of properties across Golden Plains Shire based on the number of hens kept and determine the breakdown by volume of hens. Of the properties that kept at least 1 hen (339), the breakdown of the properties was as follows:
 - a. Proportion of properties with hens which were large commercial producers: 3.5%
 - b. Proportion of properties with hens which have >200 hens: 2.4%
 - c. Proportion of properties with hens which had between 16-200 hens: 27.3%
 - d. Proportion of properties with hens which have <15 hens: 66.8%
2. Based on these figures and comparing with the total count of properties in the Shire (7,558), we determined the proportion of total properties in the Shire that had hens, excluding large commercial producers. This breakdown ended up being:
 - a. Proportion of total properties which have >200 hens: 0.1%¹⁵
 - b. Proportion of total properties which have 16-200 hens: 1.2%¹⁶
 - c. Proportion of total properties which have <15 hens: 3.0%¹⁷
3. Determine the proportion of each of the three classes and how they will be divided between metropolitan and regional properties. For our analysis, we assumed the following:
 - a. Properties which have >200 hens: Assume all are regional
 - b. Properties which have 16-200 hens: Assume 90% are regional, 10% are metropolitan
 - c. Properties which have <15 hens: Assume 60% are regional, 40% are metropolitan
4. Based on these proportions, develop an estimate of the total number of each of the three classes by applying them to the total count of properties in metropolitan and regional Australia
5. Based on information provided by Agriculture Victoria and stakeholder consultations, we assumed the average number of birds in each class of property:

¹⁵ Calculated as $0.024 * 339 / 7,558$

¹⁶ Calculated as $0.273 * 339 / 7,558$

¹⁷ Calculated as $0.668 * 339 / 7,558$

- a. Properties which have >200 hens: Average of 250 birds
 - b. Properties which have 16-200 hens: Average of 30 birds
 - c. Properties which have <15 hens: Average of 3 birds
6. Combine the total count of properties in each class and multiply by the average number of birds in each property class to determine the total count of birds in Australia. This produces a total estimate of 1,834,082 birds in Australia.
 17. We calculate the proportion of this number of hens that must be backyard hens such that their production accounts for 30 per cent of total egg production in the informal sector, which is 764,201 hens¹⁸.
 18. We then use this figure to calculate the balance of the number of hens, which must be in the micro-commercial sector – 1,069,881
 19. Using the proportion of eggs contributed and the productivity of backyard and micro-commercial hens, we calculate the total number of eggs produced by these hens
 20. Using this method, the total number of hens is 1,834,082 and eggs produced is 287,301,356.

Distribution modelling – VIC

Based on PIC counts of properties with less than 1,000 hens in Victoria provided by Agriculture Victoria, and the approximate proportion of properties with particular volumes of hens derived from the Golden Plains Shire model, we modelled a statistical distribution that was consistent with this allocation of properties.

1. Based on details provided by Agriculture Victoria on the total number of PICs with less than 1,000 hens and total counts of birds under these PICs, we calculated the average number of birds per property in Victoria.
2. Using this value, and assuming the breakdown of properties which kept hens in Golden Plains Shire held true across the state, we developed a distribution that roughly aligned with these parameters. This allowed us to develop an estimate of the total number of hens in Victoria (410,623).
3. We then extrapolated to the whole of Australia, based on the population ratio of Victoria to Australia. This produced an estimate of 1,583,779 hens across all of Australia.
4. We calculate the proportion of this number of hens that must be backyard hens such that their production accounts for 30 per cent of total egg production in the informal sector, which is 659,908 hens
5. We apply the assumed productivity rates of the backyard and micro-commercial hens to derive the estimate of the total number of eggs produced
6. Using this method, the total number of hens is 1,583,779 and eggs produced is 248,092,415.

¹⁸ This figure is calculated by $1,373,110 * 0.5 / (0.5+0.7)$

Sustainability Framework model

The Australian Eggs Sustainability Framework survey is an annual survey undertaken by Voconiq on behalf of Australian Eggs to determine and examine the relationship between the Australian egg industry, communities and the environment that seeks to develop and maintain a clear set of principles that will increase productive engagement with Australians and drive continuous improvement within the industry.

Two questions included in the Australian Eggs Sustainability Framework survey ask respondents whether they keep hens in their household, and if so, how many hens they keep. These figures were collated for each state and provided to Sapere for each year between 2018 and 2021, which formed the basis of this model.

1. We collated the answers for each state for responses for two questions in the Sustainability Framework survey for each year between 2018 to 2021:
 - a. Do you keep hens in your household?
 - b. How many hens do you keep in your household?

Based on these responses, we derived an average value for both questions.

2. The average value for the proportion of households that kept hens was then multiplied by the number of households reported in each state as of 2021 to calculate the total count of households in each state that keeps hens¹⁹
3. This total count was then multiplied by the average number of hens kept reported for each state to derive a preliminary total count of hens in each state
4. Upon consultation with the survey designer of the Sustainability Framework survey, we received advise that the proportion of households that report that they keep hens could be overstated due to factors such as careless reporting or selection bias. To that end, we made an adjustment to reduce the total count of hens by a third to account for this overrepresentation.
5. We calculate the proportion of this number of hens that must be backyard hens such that their production accounts for 30 per cent of total egg production in the informal sector (we assume that this ratio is consistent across all states). This produces an Australia-wide total of 1,572,383 backyard hens.
6. We then use this figure to calculate the balance of the number of total hens, which must be in the micro-commercial sector – 2,201,336 hens.
7. Using the proportion of eggs contributed and the productivity of backyard and micro-commercial hens, we calculate the total number of eggs produced by these hens
8. Using this method, the total number of hens is 3,773,719 and eggs produced is 591,137,387.

¹⁹ Statista (2019). Number of households in Australia from 2016 to 2041, by state. Retrieved from <https://www.statista.com/statistics/608977/australia-households-by-state/>

OmniPoll consumption model

OmniPoll is a market research firm which undertakes market research on behalf of Australian Eggs on the mean weekly consumption of eggs. Omnipoll asks survey respondents the following question:

'Thinking about all the different way you might eat eggs. In the past week, how many eggs have you consumed in total at home or away from home?'

Based on data on the weekly egg consumption reported by OmniPoll for April 2021, we developed an estimate of the total number of eggs consumed in a year and compared this figure to the total number of eggs produced by commercial producers.

1. Based on the OmniPoll figure for weekly egg consumption reported for April 2021, we developed an estimate of annual p egg consumption of 255.5 eggs per capita. We multiplied this figure by the total Australian population to produce an estimate of 6,564,917,412 eggs consumed per year.
2. We compared this to the reported annual egg consumption from commercial producers for April 2021, which was reported at 247.6 eggs per capita. We multiplied this figure by the total Australian population to produce an estimate of 6,362,156,590 eggs consumed per year.
3. Subtracting these two figures from each other, we derive a 'gap' in the number of eggs consumed of 202,760,821 eggs.
4. Based on the assumed proportion of eggs produced by backyards as 30 per cent, we estimate that the number of backyard eggs produced each year is 60,828,246.
5. The balance of the number of eggs is then assumed to be the total number of eggs produced from the micro-commercial sector, which is estimated at 141,932,575 eggs.
6. We then apply the assumed productivity ratios to each of these numbers to derive the number of birds in each sector.
7. Using this method, the total number of hens is 1,282,721 and eggs produced is 202,760,821.

About Sapere

Sapere is one of the largest expert consulting firms in Australasia, and a leader in the provision of independent economic, forensic accounting and public policy services. We provide independent expert testimony, strategic advisory services, data analytics and other advice to Australasia's private sector corporate clients, major law firms, government agencies, and regulatory bodies.

'Sapere' comes from Latin (to be wise) and the phrase 'sapere aude' (dare to be wise). The phrase is associated with German philosopher Immanuel Kant, who promoted the use of reason as a tool of thought; an approach that underpins all Sapere's practice groups.

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