

LiveCorp Submission

Updated on have your say: 14/09/2023

LiveCorp has provided an update to its submission to address an error in the modelling for the FTE estimates in the Attachment *Performance and value of the live sheep export trade* prepared by ACIL Allen.

ACIL Allen advised LiveCorp of this error in its modelling. ACIL Allen has corrected the error and updated the direct FTE numbers (and related charts) for the national and Western Australian sheep industry in the report so that the figures accurately reflect the industry and the live sheep export trade's performance and value.

The updated version of the report (dated August 2023) was provided by LiveCorp on 7 September 2023 has been added to the have your say website under the new heading, 0821 Live Corp (Updated).

The original submission and attachments will remain published under its original title.

Any questions relating to this change please contact, Livesheep.phaseout@aff.gov.au

Thankyou,

Live Sheep Phase out Secretariat.

August 2023

Report to LiveCorp and Meat & Livestock Australia

Performance and value of the live sheep export trade

Final report



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LiveCorp and Meat & Livestock Australia acknowledge the contribution from the Commonwealth of Australia to research and development undertaken in the LEP RD&E Program.

ACIL Allen, Performance and value of the live sheep export trade, August 2023.

This is a revised version of ACIL Allen, Performance and value of the live sheep export trade, June 2023.

This version corrects a modelling error that affected the direct Full-Time Equivalent (FTE) numbers. Our dedication to precision prompted a thorough review and subsequent adjustment, and the FTE figures now accurately reflect the trade's performance and value.

Reliance and disclaimer

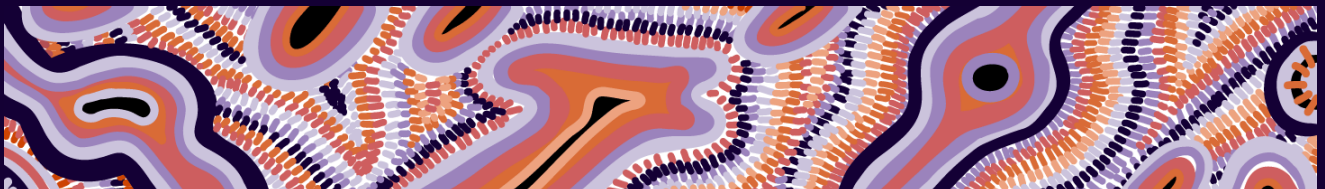
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Goomup, by Jarni McGuire

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Executive summary

Background

Live sheep exports have been an important option for sheep producers over many years. Over time there has been a decline in live sheep exports nationally and now 99% of live sheep exports are from the Western Australian production system.

Since 2017 several factors have been identified which may have contributed to the decline in live sheep exports. These include but are not limited to:

- good seasonal conditions across Australia, meaning:
 - the production of higher quality sheep which are more likely to be slaughtered domestically for sheepmeat
 - also influenced by changes in domestic sheep prices leading to an increase in transfer of sheep to Eastern states ¹
 - the potential shift away from sheep production to cropping, further influenced by relatively high grain prices
- some sheep producers may have chosen to transition their businesses away from live sheep exports (because of the good seasonal conditions but also anecdotally due to changing government and consumer sentiment) ²
- changes in regulation focused on improvements in animal welfare specifically:
 - ceasing shipments to the Middle East during the northern hemisphere summer
- relatively high price of Australian live sheep exports relative to competitor product (e.g., live sheep from Romania)
- impacts associated with the COVID-19 pandemic. ³

In March 2023, the Australian Government announced both its commitment to phasing out the live export of sheep by sea and the appointment of an independent panel to examine this issue. The panel is expected to report to the Minister for Agriculture, Fisheries and Forestry on 30 September 2023.⁴

¹ Refer: <https://episode3.net/livestock/the-sun-also-rises-in-the-east/>

² From consultation with industry stakeholders.

³ From consultation with industry stakeholders.

⁴ Refer: <https://www.agriculture.gov.au/biosecurity-trade/export/controlled-goods/live-animals/livestock/live-sheep-exports-phase-out>

Objectives

This study aims to better understand how the live sheep export industry contributes to and demonstrates economic benefits nationally and in Western Australia. The objectives of this project were achieved.

There are three main outputs of this project:

1. The value and importance of the sheep industry supply chain to the:
 - a) Australian economy
 - b) Western Australian economy
2. A point in time estimate of the impact of a cessation of the live sheep export industry's activities.
3. An assessment of Australia's key live sheep export markets, a sub-set of five countries (Israel, Jordan, Kuwait, Oman, and the United Arab Emirates (UAE)) in the Middle East and North Africa (MENA) region.

Methodology

This project uses a range of different methodologies to achieve its objectives, including:

- Input-Output analysis
- Real options analysis
- A desktop review and qualitative analysis of key international markets.

Results/key findings

Over the last five years, the average annual value of the live sheep export trade was \$143 million.

Economic contribution

National economic contribution

The live sheep export industry (live sheep and the associated wool clip) has, using an average of the last five financial years (2017-18 to 2021-22):

- Directly contributed \$52 million of value-added and directly employed 168 FTEs post farm-gate annually.
 - This accounts for 1.4% of the national sheep industry value-added.
- A total (indirect plus direct) contribution upper bound of \$86 million value-added and employed 320 FTEs annually.

Western Australia's economic contribution

The live sheep export industry (live sheep and the associated wool clip) has, using an average of the last five financial years (2017-18 to 2021-22):

- Directly contributed \$45 million of value-added and directly employed 152 FTEs post farm-gate annually.
 - This accounts for 6.1% of the total sheep industry value-added in Western Australia.
- A total (indirect plus direct) contribution upper bound of \$71 million value-added and employed 249 FTEs annually.

Real options analysis

- Using a point in time model, results show that if the live sheep export trade ceased there is an estimated 19.19% reduction in the per head value of a male sheep in Western Australia, or in dollar terms a decline of \$21.84 per male sheep (based on current prices) with a price response.
- It is important to note that the model used for this project is a point-in-time model and does not incorporate dynamic elements. As such, it does not account for seasonal climate variations or market conditions that may fluctuate over time.

Markets and trade

- Australia has a significant and sustained presence in both the live sheep market and the sheepmeat market in the Middle East.
- In recent years, five countries (Israel, Jordan, Kuwait, Oman, and the UAE) have imported more than 80% of Australian live sheep exports.
- Based on available data (which is limited), it is concluded that these countries will raise their live product imports from other nations rather than substantially increase their imports of Australian boxed or chilled sheepmeat if Australia ceased its live sheep export trade.

Future research and recommendations

This project was constrained by the limited availability of public information, particularly quantitative data from the specific countries of focused. Therefore, future research endeavours should prioritise the quantification of the potential impact if Australia were to cease its live sheep export trade in the Middle East. Additionally, expanding the analysis to encompass all importers of Australian live sheep would provide a more comprehensive understanding of the trade dynamics.

Potential areas of focus for future research could include:

- Quantifying the trade implications of discontinuing live sheep exports from Australia.
- Conducting a thorough trade analysis encompassing all countries that import live sheep from Australia.
- Updating the assumptions of the real options model to incorporate market dynamics and climate-related factors such as drought conditions.
- Collecting primary data to better inform the real options model.

By addressing these research gaps, future studies can contribute to a more comprehensive and nuanced understanding of the implications, challenges, and opportunities associated with potential changes in Australia's live sheep export trade in the Middle East and beyond.

Introduction

1

1.1 Background

Over recent years, the number of sheep being exported live from Australia has been declining. Live sheep exports fell from 1.18 million head in 2018 to just over 500,000 in 2022 (an annual average decrease of 31%). Changes in animal welfare standards and other factors may have contributed to significant changes in the export of live sheep out of Australia.

Regulatory changes have led to the cessation of shipments to the Middle East during the northern hemisphere summer, the introduction of Independent Observers, increased space on ships for sheep, heat management plans, increased ventilation requirements, and automatic environmental sensors on ships.

Animal welfare has been an area of continual improvement through regulatory change, industry initiatives, and research. As a result, the average annual mortality rate of sheep shipments has decreased from 0.71% between 2013 and 2017 to 0.24% between 2019 and 2021. This represents a reduction of approximately 67% between the two periods.

These improvements were highlighted by the Al Kuwait voyage, which departed Western Australia in May 2020 after receiving an exemption to sail during the northern summer prohibition after a delay due to COVID-19. The ship had 33,341 sheep on board and delivered the lowest mortality rate ever recorded at that time, at any time of year (0.08%).

The Australian Government has announced its commitment to phasing out the live export of sheep by sea and announced an independent panel has been appointed and is expected to report to the Minister for Agriculture, Fisheries and Forestry on 30 September 2023.⁵

Other changes since 2017 which may have contributed to the decline in live sheep exports include but are not limited to:

- good seasonal conditions across Australia, meaning:
 - the production of higher quality sheep which are more likely to be slaughtered domestically for sheepmeat
 - also influenced by changes in domestic sheep prices leading to an increase in transfer of sheep to eastern states⁶
 - the potential shift away from sheep production to cropping, further influenced by relatively high grain prices

⁵ Refer: <https://www.agriculture.gov.au/biosecurity-trade/export/controlled-goods/live-animals/livestock/live-sheep-exports-phase-out>

⁶ Refer: <https://episode3.net/livestock/the-sun-also-rises-in-the-east/>

- some sheep producers may have chosen to transition their businesses away from live sheep exports (as a result of the good seasonal conditions but also anecdotally due to changing government and consumer sentiment)⁷
- relatively high price of Australian live sheep exports relative to competitor products (e.g., live sheep from Romania)
- impacts associated with the COVID-19 pandemic.⁸

1.2 Objective

This study aims to assess and demonstrate the economic contribution made by the live sheep export industry nationally and in Western Australia (where the majority of sheep destined for live export are produced), and its benefit to sheep producers.

There are three main outputs of this project:

1. The value and importance of the sheep industry supply chain to the:
 - a) Australian economy
 - b) Western Australian economy
2. A point in time estimate of the impact of a cessation of the live sheep export industry's activities.
3. An assessment of Australia's key live sheep export markets, a sub-set of five countries (Israel, Jordan, Kuwait, Oman, and the UAE) in the Middle East and North Africa (MENA) region.

Socio-economic profiles of each of these countries can be found in Appendix A.

The objectives have been achieved; however, the availability of public data limits the assessment of the markets and trade components of the project.

1.3 Methodology

This project uses a range of different methodologies to achieve its objectives. Each technique is summarised below, and further detail is available where relevant in the appendices. The Input-Output analysis and real options analysis was successful in achieving its outcome.

The desktop review and qualitative analysis was successful. However, it is limited in the availability of official public data, reports, and information.

1.3.1 Input-output analysis

Input-Output (I-O) analysis is used to estimate the economic contribution of an industry using key measures:

- Value-added — this measures the industry's contribution to the economy (i.e., its contribution to Gross State Product or Gross Domestic Product) by measuring the industry's impact on wages, salaries, profits, and indirect taxes. Value added is the preferred measure of economic contribution.
- Employment — this measures the industry's contribution in terms of the number of direct and indirect jobs (as full-time equivalent (FTE)) supported.

Further details on the analytical technique are provided in Appendix B.

⁷ From consultation with industry stakeholders.

⁸ From consultation with industry stakeholders.

The estimated value added and employment contributions from the industry to the national and Western Australian economies are outlined in the sections below and are presented as direct impacts and broader economic impacts (indirect impacts) for an upper and lower bound.

- Upper bound is the impact including the direct effects plus flow on effects from inter-industry purchases plus the flow on effects from employees' spending.
- Lower bound is the impact including the direct effects plus flow on effects from inter-industry purchases.

The analysis was conducted using an average of the last five financial years (2017-18 to 2021-22). Data was sourced from Australian Bureau of Statistics (ABS) including the National Accounts Input-Output data and additional industry level data from ABS, WA Department of Primary Industries and Regional Development (DPIRD) and Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES).

1.3.2 Real options analysis

A real options analysis is used to estimate the difference in the value of all male sheep in Western Australia on a per head basis with and without access to the live sheep export markets.⁹

For this project, ACIL Allen's sheep model, which utilises real options analysis¹⁰, was employed and tailored to the specific requirements. The model was updated with the latest available data from 2021-22. It is important to note that the model used for this project is a point-in-time model and does not incorporate dynamic elements. As such, it does not account for seasonal climate variations or market conditions that may fluctuate over time.

Real options valuation methods estimate the value of the opportunity (here the option to live export sheep), but not the obligation to take that option. Typically, real option values rise as uncertainty rises.

Access to the live sheep export market influences whole of enterprise decision making. It may influence the way in which producers manage the use of the resources on the farm where sheep are, or could be, part of the farming system. Having access to this market influences the breeding, culling, pasture management and genetics decisions of the producer for the whole enterprise.

The model is based on the turn-off (slaughter or live export) of Merino¹⁰ male sheep (wether sheep and wether lamb)¹¹ in the Western Australian system.

Turn-off is how sheep are disposed of at the end of their productive lives. Total turn-off in 2021-22 was approximately one third of the Western Australian flock. Male sheep are examined because the live sheep export industry is dominated by male sheep (approximately 95% of sheep exported live in 2020 were wethers).¹²

Interstate transfer is not considered in the model as when the model was developed it was a very small proportion of turn-off (Refer Table 2.2). Although interstate transfer has increased in recent years it is still largely circumstantial and dominated by breeder sheep (ewes and rams) (Refer Box 2.2).

⁹ The majority of sheep that are live exported are wethers. It should be noted that around 5% of the trade in 2020 were rams and ewes, not wethers.

¹⁰ Merinos make up approximately 85% of the Western Australian flock.

¹¹ A wether is usually considered a castrated/neutered adult male sheep. However, the term wether lamb is also used, this would refer to castrated lambs under 12 months of age or without any permanent incisor teeth in wear. Refer Box 2.1 and https://www.learnaboutwool.com/globalassets/law/resources/factsheets/secondary/gd3270-secondary-fact-sheet_2019_c.pdf

¹² Refer: <https://livecorp.com.au/report/24Y2N6MZfAdwHlqCNznkZ>

The value of access to markets is presented on a per head basis as a net present value (NPV). NPV calculations estimate the present value of a series of cash flows, to allow comparisons in the value of sheep, with and without access to the live sheep export trade.

An immediate (within 12 months) cessation scenario was modelled. Options included with and without price responses, meaning that one option assumed that prices would not change if live sheep exports ceased and the other assumed that price would change.

The base case scenario includes all the direct inputs, such as drench, vaccination, shearing and crutching, and an allocation of pasture maintenance costs and direct enterprise labour. It does not include allocations for overheads such as general labour, administration costs, interest, or tax. These calculations have used a 7.5 per cent weighted average cost of capital (WACC) to calculate the present value.

The Western Australian sheep industry

2

This study aims to understand how the live sheep export industry contributes to the national economy. However, as the majority (between 80% and 99% over the last five years) of sheep for live export are produced in Western Australia it is important to discuss the Western Australian sheep industry as this is where most of the economic contribution is attributed.

The sheep industry in Western Australia is characterised by a predominately Merino (wool) breed of sheep, with a small number of British bred Merino crossbreds, dual purpose, and specialist sheepmeat breeds. This allows the industry to produce both high-quality wool from adult animals and sheepmeat from lambs. Over time there has been an increasing focus on sheepmeat production in Western Australia and reduced reliance on wool production. As such the Western Australian flock has restructured to a higher proportion of ewe breeding animals versus wethers (refer Box 2.1).

The live export market is a good fit for wether sheep for numerous reasons:

- it's a flexible market that can take animals from lambs through to adults
- those animals that don't meet the weight or other specifications required for the prime lamb market can find a viable market in live exports
- there is no need for pregnancy testing (an added cost that must be done within 30 days of export).

2.1 The value of sheep to the WA economy

The Western Australian agri-food and fibre production sector was worth \$14 billion in 2021-22. Sheep (live export and slaughter) accounted for \$692 million (5%), and wool accounted for \$655 million (4.7%). This combined is \$1,347.1 million (9.7 per cent) in total.¹³ Refer Table 2.1.

In 2021-22, live sheep exports represented 11% by volume and 7% by value of the Western Australian sheep industry accounting for \$99 million in total export value (live sheep and the associated wool clip).

This is a significant decline over time. In 2010-11 live sheep exports represented 33% by volume and 25% of value to the sheep industry. Most of the decline can be seen since 2018-19 in terms of volume following on from a decline in value from 2017-18. Refer Table 2.1.

¹³ ABS (2023), Agricultural Commodities.

Table 2.1 Western Australia sheep statistics, 2010-11 to 2021-22

	Units	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Head	million												
Sheep slaughtered	000	1,282	743	1,431	1,562	1,327	1,358	941	1,368	1,396	1,771	1,381	1,156
Lambs slaughtered	000	2,057	1,733	1,908	2,386	2,353	2,753	2,876	2,630	2,691	2,457	2,296	2,508
Live sheep exported	000	2,288	1,813	1,717	1,783	1,788	1,669	1,682	1,603	895	1,065	585	487
Total turn-off	000	6,913	4,351	5,194	5,888	5,512	5,859	5,813	5,857	5,128	6,655	5,624	4,419
Live sheep export % of turn-off	%	33%	42%	33%	30%	32%	28%	29%	27%	17%	16%	10%	11%
Mutton produced	000	27.8	16.8	31.5	35.9	30.3	33.4	23.9	32.8	35.1	43.0	34.8	31.8
Lamb produced	tonnes(cw)	43.4	36.9	39.6	50.1	49.4	57.9	62.7	53.5	56.2	52.9	52.0	58.4
Value lamb and mutton	\$m	531	485	337	410	479	513	551	584	547	690	608	692
Wool produced	000 tonnes	65.1	71.0	71.8	67.2	65.2	71.1	65.1	62.1	59.6	56.2	59.7	58.5
Value of wool produced	\$m	557	549	521	582	540	661	826	995	976	637	570	655
Total sheep industry value	\$m	1,088	1,034	858	992	1,019	1,174	1,377	1,579	1,523	1,327	1,178	1,347
Value of live sheep exports	\$m	220	215	145	194	204	196	210	126	136	126	92	82
Value of wool live sheep exports ^a	\$m	57	54	46	48	50	60	59	68	43	39	18	17
Total value of live sheep exports	\$m	277	269	191	242	254	256	269	194	179	165	110	99
Live sheep exports as a % of value	%	25%	26%	22%	24%	25%	22%	20%	12%	12%	12%	9%	7%

Note: ^a ACIL Allen estimate based on the sheep categories exported, wool yield per animal and wool price. cw= carcass weight.

Source: ACIL Allen analysis based on ABS and WA Department of Primary Industries and Regional Development

2.2 The Western Australian sheep flock

In 2021-22, Australia's sheep flock comprised 70.24 million head,¹⁴ reflecting a growth of 3.2% compared to the previous financial year. Projections indicate that the national sheep flock will continue to expand, reaching an estimated 78.85 million head by 2023, which would be the highest level recorded since 2007.¹⁵ However, in Western Australia, the sheep flock experienced a decline of 2% to reach 12.4 million head in 2021-22.¹⁶ The Western Australian sheep flock represents approximately 18% of the national flock. Refer Figure 2.1.

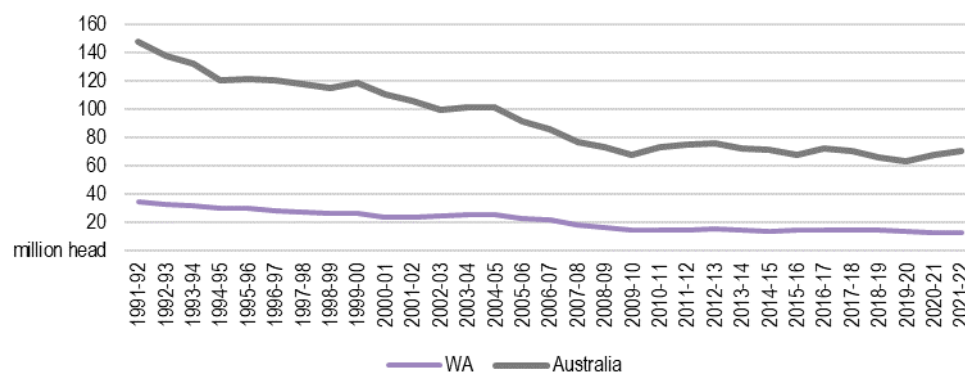
¹⁴ Australian Bureau of Statistics 2022. *Agriculture Commodities*.

<https://www.abs.gov.au/statistics/industry/agriculture/agricultural-commodities-australia/latest-release#:~:text=Australia's%20sheep%20flock%20increased%203,lambs%20at%2030%20June%202022>

¹⁵ Refer: <https://www.mla.com.au/news-and-events/industry-news/australias-sheep-flock-to-reach-largest-size-in-over-15-years/>

¹⁶ The decline in flock in Western Australia has been a long-term issue.

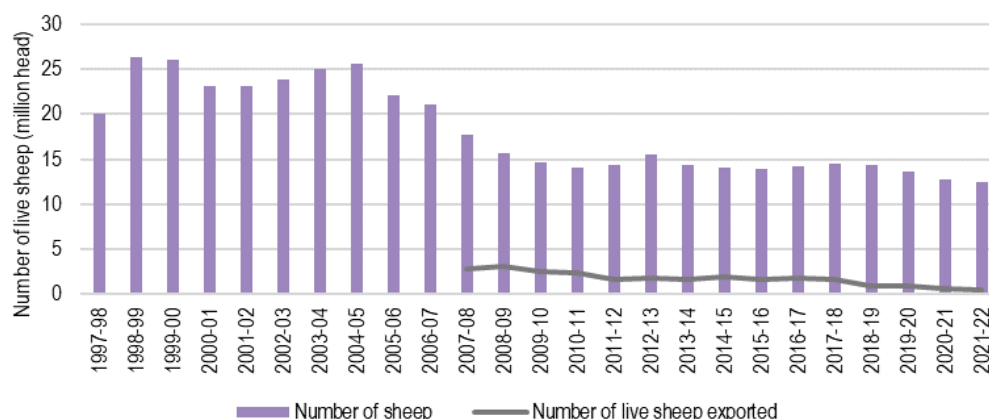
Figure 2.1 National and Western Australia flock size over time



Source: ACIL Allen based on Australian Bureau of Statistics and Department of Agriculture, Fisheries and Forestry, 2023

Western Australia's sheep flock has been decreasing since 2004-05, although the rate of decrease has slowed since the early 2010s when the wool price stabilised. Live sheep exports from Western Australia comprised around 3.8% of the total number of sheep in the state in the 2021-22 financial year, down from 6.9% from the 2018-19 financial year. Figure 2.2 shows the sheep flock in Western Australia over time and the comparative number of sheep exported overseas from the state.

Figure 2.2 Number of sheep in and live sheep exported from Western Australia, 1997-98 to 2021-22



Note: Includes sheep and lamb.

Number of live sheep exported from 2007-08 to 2016-17 were based on calendar year instead of financial year due to data limitations.

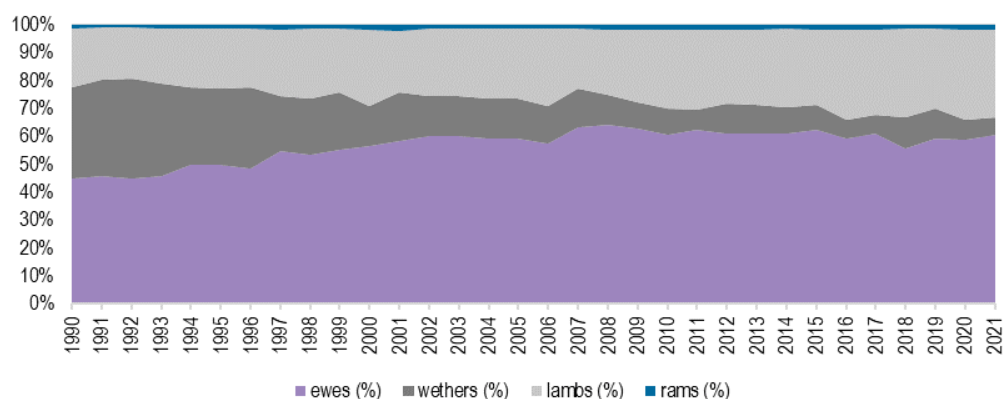
Source: ACIL Allen based on Australian Bureau of Statistics and Department of Agriculture, Fisheries and Forestry, 2023

In Western Australia, the proportion of ewes in the flock has been increasing since 1990. Ewes now comprise the largest proportion of the flock, accounting for 60% in 2021, compared to 45% in 1990.

This shift indicates a restructuring of the industry toward sheepmeat production. This implies a greater demand for breeding animals in the system, resulting in a surplus of wethers, particularly during periods of unfavourable seasonal conditions when feed is scarce or supplementary feed is expensive. When ewes reach the end of their productive lives, they are typically sold into the domestic slaughter market.

The proportion of wethers has decreased significantly, to over 6% (2021) from 32% (1990), whilst lamb numbers have increased 10% in the last 20 years. There has been little change to the ram numbers over time.¹⁷ Refer Figure 2.3.

Figure 2.3 Sheep flock composition in Western Australia, 1990-2021



Source: ACIL Allen based on Department of Primary Industries and Regional Development, 2023 from ABARES/MLA data, DPIRD analysis

Box 2.1 Sheep types and age

In the AUS-MEAT Language, dentition is used as a measure of approximate age in order to determine both basic and alternative categories for sheepmeat:

- a lamb has milk teeth only
- 12-18 months = two-tooth (a typical live sheep export lamb is a two-tooth sheep)
- 18 months to 2 years = four-tooth
- 2-3 years = six-tooth
- Sheep are no longer considered lambs once the first adult teeth are cut (have come through), at roughly 14 months of age
- An adult sheep has 8 incisor teeth.

In terms of sheepmeat – the three basic categories are lamb, mutton, and ram. Lamb and ram are defined below. Mutton is meat derived from either wethers (with no evidence of secondary sexual characteristics) or ewes and are typically over 10 months of age.

Lambs: An ovine animal that is (a) under 12 months of age; or (b) does not have any permanent incisor teeth in wear. A wether lamb is a castrated lamb over 12 weeks and under 12 months of age.

Hoggets: are an immature male and female sheep older than weaners but not yet adults. Although often kept through to adults, hoggets do not produce as much wool as adult sheep.

Wethers: are male sheep that have been castrated so they cannot breed. Wethers are primarily used for wool production. Wethers are the most common sheep type that are live exported.

Ewes: are adult female sheep. Ewes are used for breeding and for wool production.

Rams: Typically, entire male ovine animals that are over at least 10 months of age (with at least 1 permanent incisor tooth in wear). Rams can be castrated or not, but to be classified as a ram the animal needs to show secondary sexual characteristics.

Source: https://www.ausmeat.com.au/WebDocuments/Producer_HAP_Sheepmeat_Small.pdf and https://www.learnaboutwool.com/globalassets/law/resources/factsheets/secondary/gd3270-secondary-fact-sheet_2019_c.pdf

¹⁷ The definition of a lamb changed in 2019. Refer Box 2.1 for information on sheep types. This means that a lamb is now able to cut one or both of its permanent central incisor teeth as long as they are not in wear.¹⁷ This may contribute to the reduction of wethers and the increase in lambs since 2019.

2.3 Turn-off in Western Australia

Lamb and sheep slaughter has remained steady in Western Australia with approximately 2.5 million lambs and 1.3 million sheep slaughtered each year. Refer Figure 2.4.

Data from 2021 suggests sheep disposals are primarily attributed to slaughter (75%), with live sheep exports accounting for 11%, while interstate transfers represent 14%. Refer Figure 2.5.

These figures indicate that the majority of sheep in Western Australia are processed for meat production within the state, with a smaller portion exported live or transferred to other states.

The five-year averages for each of the four categories is presented in Table 2.2.

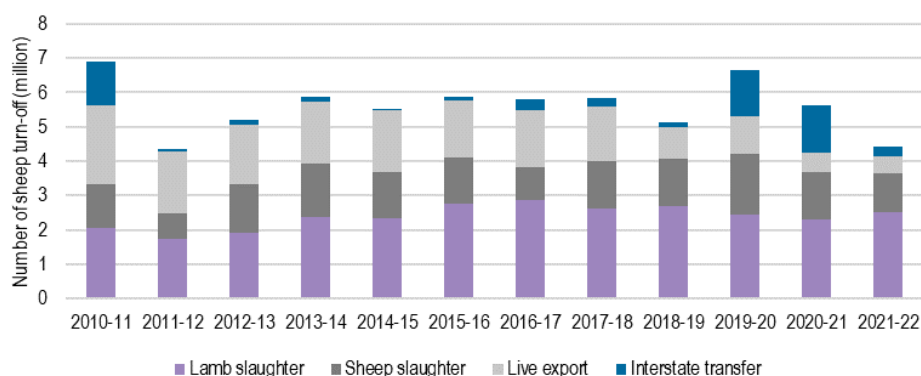
Table 2.2 Proportion of Western Australia sheep by turn-off category (five-year average)

Five-year period	Lamb slaughter	Sheep slaughter	Live sheep export	Interstate transfer
2017-18 to 2021-22	45%	26%	17%	12%
2012-13 to 2016-17	43%	23%	31%	3%

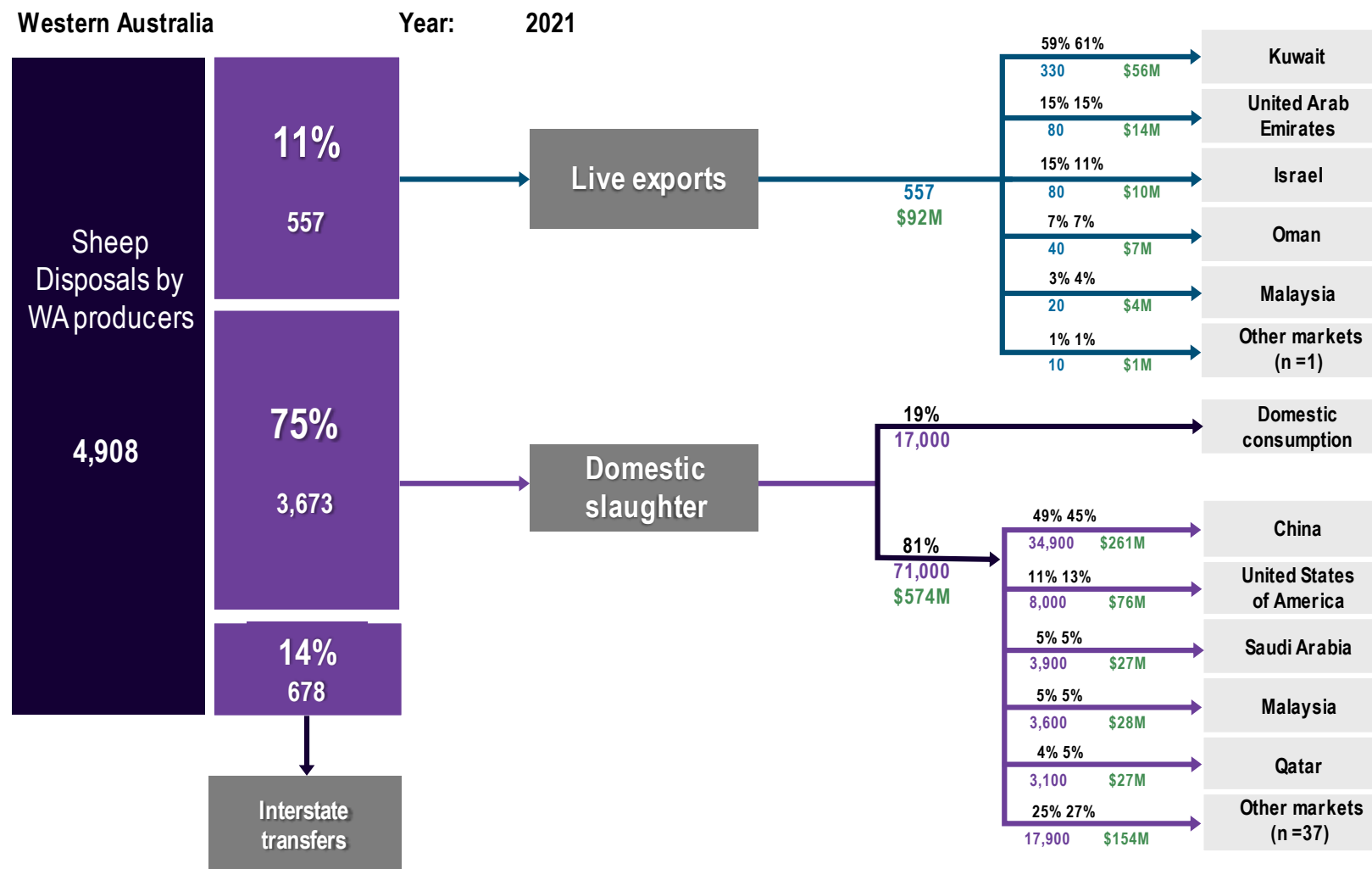
Source: ACIL Allen based on Department of Primary Industries and Regional Development, 2023

As shown in Figure 2.4, interstate transfer was small in volume between 2011-12 and 2018-19 but was significantly higher in 2019-20 and 2020-21. This broadly aligns with the drought breaking in the eastern states. It is important to note that while droughts are often associated with interstate transfers, they are not the sole reason they occur. Refer Box 2.2.

Figure 2.4 Sheep turn-off in Western Australia, 2010-11 to 2021-22



Source: ACIL Allen based on Department of Primary Industries and Regional Development, 2023

Figure 2.5 Sheep disposals Western Australia (2021)

Source: ABS data, DPIRD analysis. Available at: <https://www.agric.wa.gov.au/sheep/western-australian-sheep-and-wool-industries>

Box 2.2 Interstate transfers, droughts, prices, and the role of live export

Western Australian sheep producers (as seen in Figures 2.3 and 2.4) have several turn off (or disposal) options – slaughter within Western Australia, interstate transfer and live export.

Interstate transfers of sheep from the west to the east coast is variable (up to 70% annual variability) and is often driven by a combination of adversity (typically drought) and prices.

The end of a drought in the east (as eastern states look to rebuild their flocks) or the start of one in the west (as producers de-stock) are key drivers for interstate sheep (breeder) transfers from Western Australia to the east coast. Lambs are also transferred for restocking purposes, but when trade prices are higher in the east, they are shipped for slaughter. For lamb, if the price discount of western sheep to their eastern counterparts widens, it makes the transport worthwhile for the eastern buyer.

In 2019-20, the interstate transfers were due to restocking and were trade price influenced. The Western Australian Trade Lamb indicator was at a 22% discount in October 2020.

Episode 3 reports that drought on its own is not enough to encourage interstate transfer, pointing out that the 2014 and 2015 seasons were both dry on the east coast and very few sheep were transferred from the west. Further, they note that WA price spreads relative to the east coast prices (restocking and trade prices) decline during June to September – the period when sheep cannot be exported to the Middle East due to the Northern hemisphere summer. This is coupled with the fact that over the last two decades, the Western Australian sheep prices have, on average, been discounted relative to east coast prices.

There are potential negative impacts for Western Australian sheep producers with the removal of live exports as a disposal option if domestic price trends continue and Western Australian slaughter capacity can't absorb the additional sheep numbers.

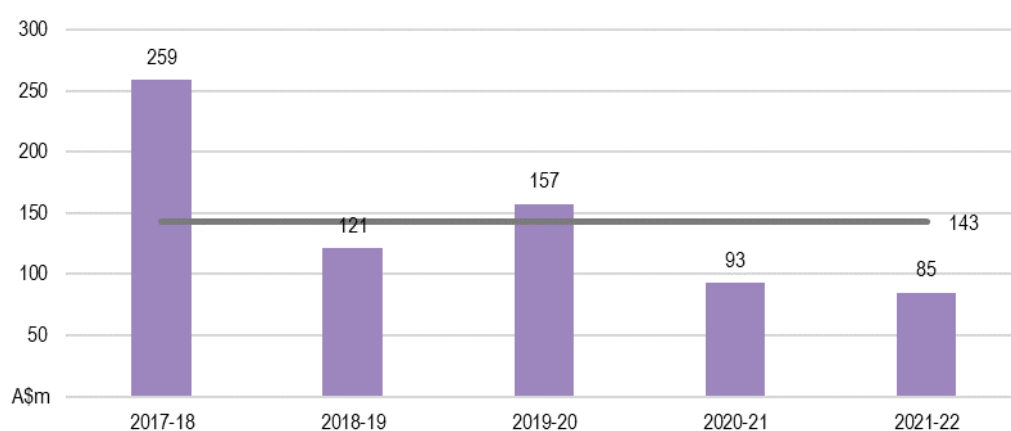
Note: Episode 3 (EP3) is an independent, data-driven market analysis service that provides premium insights and reports to the agriculture industry, food manufacturing sector and their associated markets.

Source: <https://episode3.net/livestock/the-sun-also-rises-in-the-east/> and <https://episode3.net/livestock/wa-crunched/> and <https://episode3.net/livestock/the-cheap-sheeps/> and <https://mecardo.com.au/sheep-shopping-from-west-to-east-eases/>

2.4 Live sheep exports

On a national basis the value of live sheep exports on average has been \$143 million over the last five years (2017-18 to 2021-22). Refer Figure 2.6.

Figure 2.6 Value of live sheep exports (national)

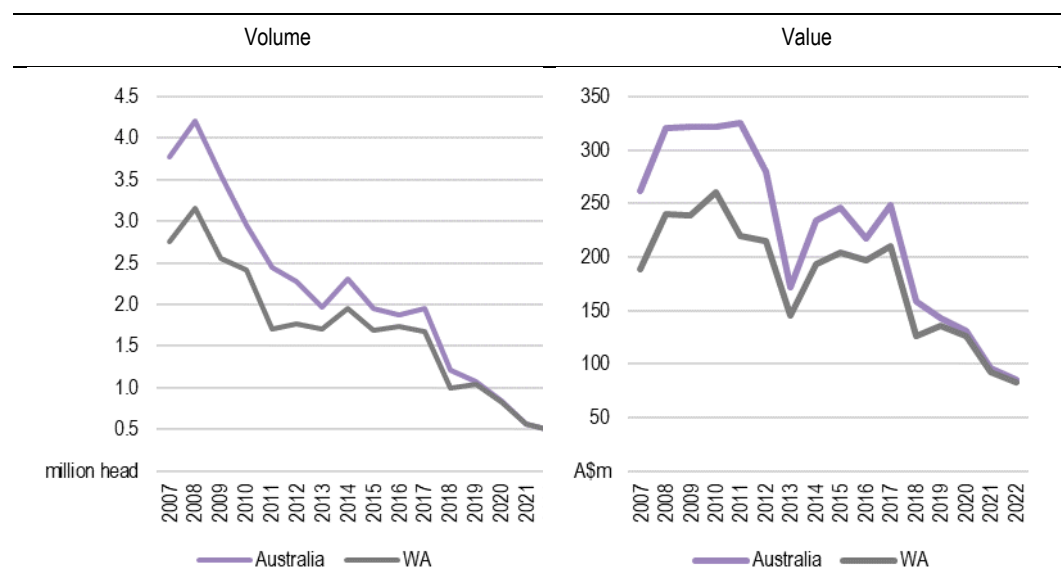


Source: ABARES, Australian Commodity Statistics, 2022.

The volume and value of live sheep exported from Western Australia relative to all Australian live sheep exports are summarised in Figure 2.7. In 2021-22, approximately half a million sheep were

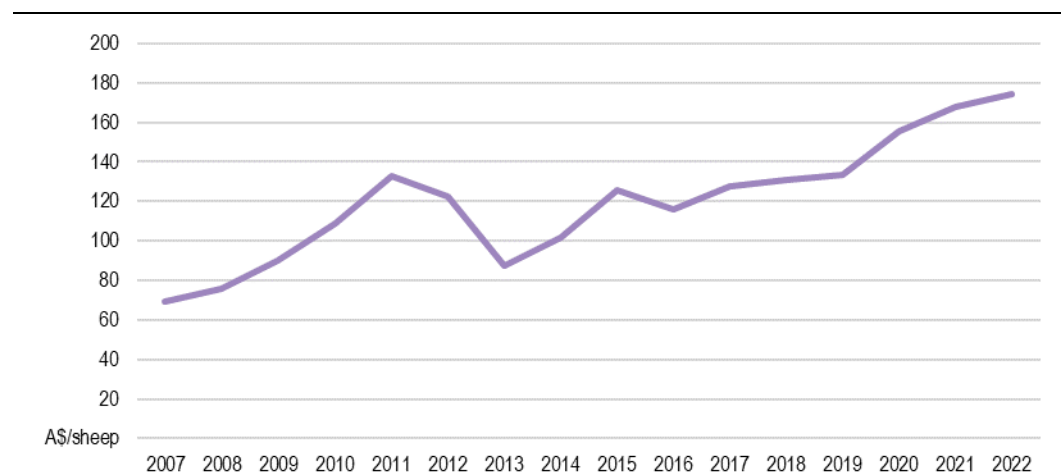
exported from Australia, with 99% of them originating in Western Australia and a total national value of \$85 million.

Figure 2.7 Live sheep exports from Western Australia and Australia, 2007-2022



Source: WA Department of Primary Industries and Regional Development, 2023

Figure 2.8 Average live sheep export price, 2007-2022



Source: WA Department of Primary Industries and Regional Development, 2023

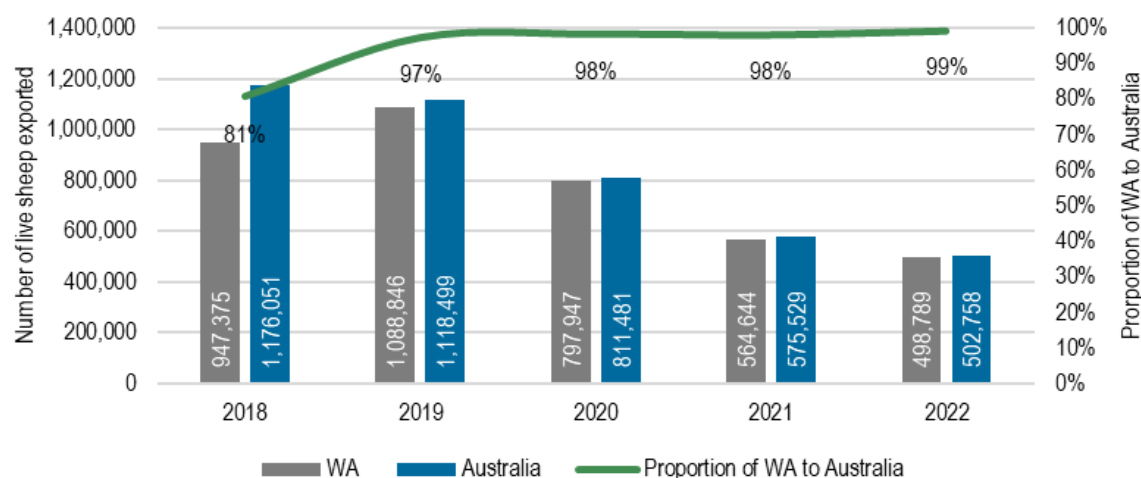
As noted above the majority (99% in 2022) of Australia's live sheep exports are from Western Australia; all shipped through the Port of Fremantle.¹⁸ In 2018, just over 200,000 slaughter sheep were also exported from the Port of Adelaide.¹⁹ Over the last five years, the number of live sheep

¹⁸ A small number of live sheep are exported by air – these are typically breeder sheep and since 2018 have flown out of Adelaide, Melbourne, and Avalon (VIC). Between 2018 and 2022 this was a total of 12,792 head of breeder sheep. Some breeder sheep also travel by sea (ex Portland (VIC)) comprising a total of 6,371 head in 2018 and 2019. Department of Agriculture, Fisheries and Forestry.

¹⁹ There were 10 shipments from the Port of Adelaide in 2018, to the Middle East and Turkey. Department of Agriculture, Fisheries and Forestry.

exported from Western Australia has fallen from just over 947,000 head in 2018 to under 490,000 head in 2022 (a 48% decrease). Refer Figure 2.9.

Figure 2.9 Live sheep exports (sea and air) by calendar year, 2018-2022



Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, February 2023

Live sheep exports are an important part of Western Australian sheep producers' strategies to manage the risks associated with a short growing season in spring. A short growing season means lambs may not reach the weight or quality standards of the prime lamb market before the hot summer conditions restrict pasture growth, necessitating supplementary feeding. This is particularly relevant in times of drought, refer Box 2.2.

Live sheep exports provide WA sheep farms with an alternative, more flexible market than prime lambs in terms of age, quality, and timing of delivery. This flexibility allows producers to adapt their marketing strategies to the prevailing seasonal conditions. For instance, if conditions prove unfavourable for producing prime lambs, producers can still sell the sheep for live export at reasonable prices.²⁰

In Western Australia, sheep are well suited to mixed-farming enterprises, and live export is one of the key outlets for sheep producers when turning off stock. It provides them with an alternative market option that enables them to optimise their production and adapt to changing circumstances.

A breakdown of sheep by class using the latest available data is provided in Table 2.3.

²⁰ ABARES (2021), The economic impact of regulating live sheep exports, Research report 21.01. February 2021.

Table 2.3 Proportion of sheep by class²¹

		2018*	2019	2020
Wethers	adults	40%	39%	31%
	hoggets	18%	16%	23%
	lambs	34%	40%	41%
Rams	adults	3%	2%	2%
	hoggets	0%	0%	0%
	lambs	2%	1%	2%
Ewes	adults	3%	1%	0%
	hoggets	0%	0%	0%
	lambs	1%	0%	1%

Note: * 2018 data includes 200,000 head of sheep shipped from the Port of Adelaide.

Source: ACIL Allen with data available from <https://livecorp.com.au/report/24Y2N6MZfiAdwHlqCNznkZ> accessed 22 May 2023

Western Australia has developed a successful live sheep export trade due to:

- comparatively lower cost of production stock
- high quality and consistency of meat
- capacity to supply large volumes of animals
- ability to provide animals with low disease incidence
- the suitability of breeds.

The Western Australian Department of Primary Industries and Regional Development note:

In 2017, prior to the new restrictions imposed on the industry, 2.0 million sheep were exported live from Australia. The value of live sheep exports was A\$249 million in 2017. Western Australia contributed 86% of live sheep exported from Australia.

In 2019, 1.1 million sheep were exported from Australia. The value of these exports was A\$143 million, a reduction of 43% when compared to 2017 due to the restrictions imposed from mid-2018. Western Australia contributed 97% of the live sheep exported from Australia in 2019.

*Western Australian DPIRD, 2020*²²

Regulatory requirements predominantly include the Australian Standards for the Export of Livestock (refer Box 2.3) and Exporter Supply Chain Assurance System (refer Box 2.4) introduced by the Australian Government.

²¹ There is no breakdown of how these classes are derived.

²² Western Australia DPIRD accessed 28 April 2023. https://www.agric.wa.gov.au/sheep/sheep-live-export?page=0%2C1#smartpaging_toc_p1_s0_h2

Several factors contribute to higher costs associated with live sheep for overseas export, including:

- Quarantine and health protocols: Live sheep exports require adherence to stringent quarantine and health protocols to ensure the animals meet the importing country's regulatory standards. These measures involve health examinations, vaccinations, and quarantine periods.
- Transport and logistics: Exporting live sheep involves significant logistical challenges. Transportation by sea or air requires specialised infrastructure and vessels equipped to handle live animals. Transportation costs include vessel chartering, animal handling facilities, and veterinary services.
- Compliance with export regulations: Adherence to Australian regulations, such as ASEL and ESCAS, is mandatory. These regulations set out specific requirements for the welfare, food provisions, and overall conditions of animals during transportation. Sea voyages carrying live sheep must also comply with standards set by the Australian Maritime Safety Authority (AMSA).
- Compliance with import regulations: Each importing country may have specific import regulations and documentation requirements for live animal imports. Complying with these regulations involves administrative procedures, certifications, and inspections.

These various factors contribute to the overall costs of live sheep exports, reflecting the stringent requirements and quality assurance measures involved in ensuring the welfare and compliance of the animals throughout the export process.

Box 2.3 Australian Standards for the Export of Livestock

The Australian Standards for the Export of Livestock (ASEL) are a set of Australian Government regulations which outline the conditions, and criteria that should be followed for the export of livestock. The standards apply to cattle, sheep, goats, deer, buffalo, and camelids exported by air or sea. There are 6 Standards:

Standard 1 Sourcing and preparation of livestock for export by sea

Standard 2 Land transport of livestock

Standard 3 Management of livestock in registered establishments

Standard 4 Vessel preparation and general management for export by sea

Standard 5 Loading and onboard management requirements

Standard 6 Air transport of livestock

The standards are extensive and specific to each different animal, although they include general and all species requirements. They also include a part-by-part breakdown of the condition of the animal when exported and arriving at its destination. The purpose of ASEL is to specify the regulatory conditions so that the quality of exported Australian livestock is as expected, and animal welfare requirements are met.

There have been multiple reviews of ASEL and it is continuously being updated to ensure the welfare of livestock being exported from Australia.

Source: Various including Department of Agriculture, Fisheries and Forestry, Australian Standards for the Export of Livestock 3.2

Box 2.4 Exporter Supply Chain Assurance System

To ensure the health and welfare of animals along the supply chain, the Exporter Supply Chain Assurance System (ESCAS) was introduced in 2011. A significant reform for the livestock export trade, ESCAS ensures the welfare of exported livestock from disembarkation in destination markets up to and including slaughter in the importing country and is based on four principles:

1. Animal welfare – animal handling and slaughter in the importing country conforms to World Organisation for Animal Health
2. Control through the supply chain – the exporter has control of all supply chain arrangements for livestock transport, management and slaughter
3. Traceability through the supply chain – the exporter can trace all livestock through the supply chain
4. Independent audit – the supply chain in the importing country is independently audited.

The aim of ESCAS is:

to ensure that Australian livestock exported for feeder and slaughter purposes are transported, handled, and slaughtered humanely for the purposes of delivering good animal welfare outcomes and facilitating the trade. A key attribute of ESCAS is that it enables the department to take action against exporters to stop the supply of livestock to specific facilities or supply chains without the need for whole-of-market suspensions.

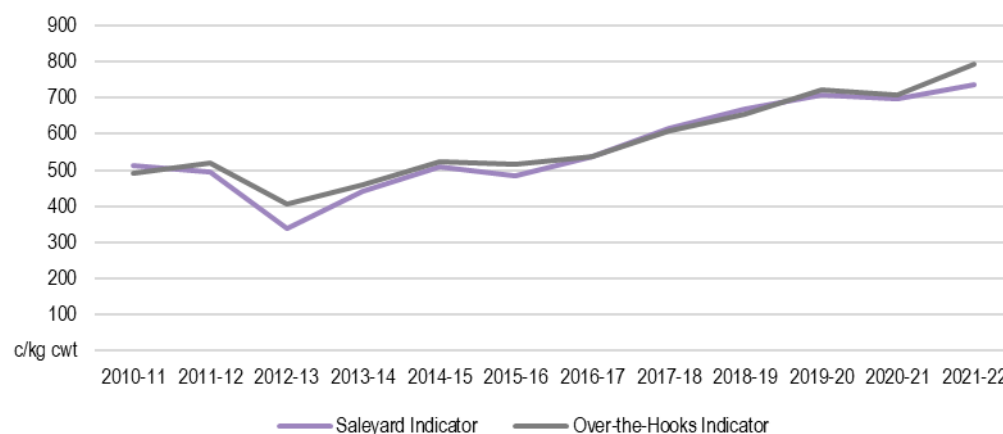
Source: Various including <https://www.agriculture.gov.au/biosecurity-trade/export/controlled-goods/live-animals/livestock/exporters/escas> and Inspector-General of Live Animal Exports, 2021, Review of the Exporter Supply Chain Assurance System, review report 2021/01.

2.5 Market conditions for sheepmeat

Sheepmeat prices have been rising over time. Figure 2.10 and Figure 2.11 show the heavy lamb and mutton indicators for sheepmeat in Western Australia. These prices are in cents per kilogram (c/kg) of carcass weight (cwt), indicating both 'over-the-hooks'²³ and 'saleyard'²⁴ prices.

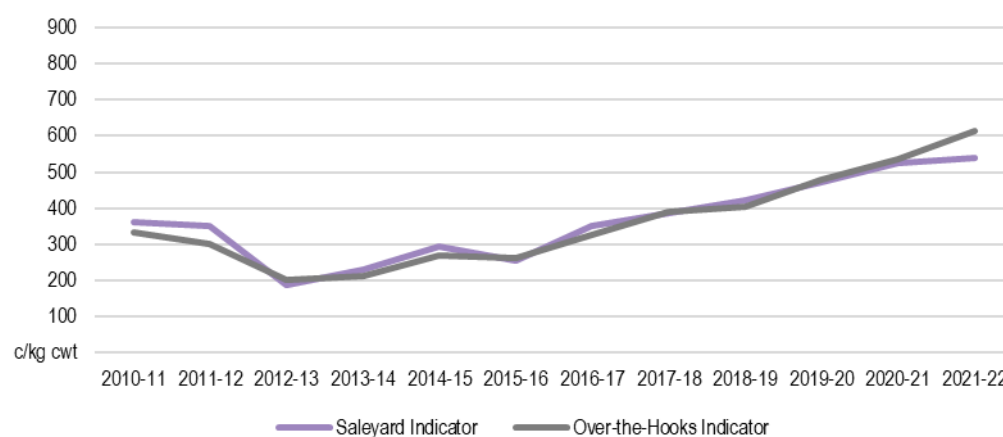
In 2021-22, the heavy lamb indicator averaged 793 c/kg cwt for over-the-hooks and 737 c/kg cwt for saleyard in Western Australia. The mutton indicator average is at 613 c/kg cwt for over-the-hooks and below 539 c/kg cwt for saleyard. Prices in 2021-22 were the strongest they have been over the last decade and have followed a similar trajectory to live sheep export prices.

Figure 2.10 Average lamb indicator price in WA, 2010-11 to 2021-22



Source: WA Department of Primary Industries and Regional Development, 2023

Figure 2.11 Average mutton indicator price in WA, 2010-11 to 2021-22



Source: WA Department of Primary Industries and Regional Development, 2023

²³ Over-the-hook sales occur when livestock are sold directly to an abattoir. Abattoirs have their own terms of sale and price penalties for animals that do not meet the agreed specifications.

²⁴ Saleyards offer the immediate sale of animals, so prices reflect demand and supply on the day, and they accept all stock types and lot sizes.

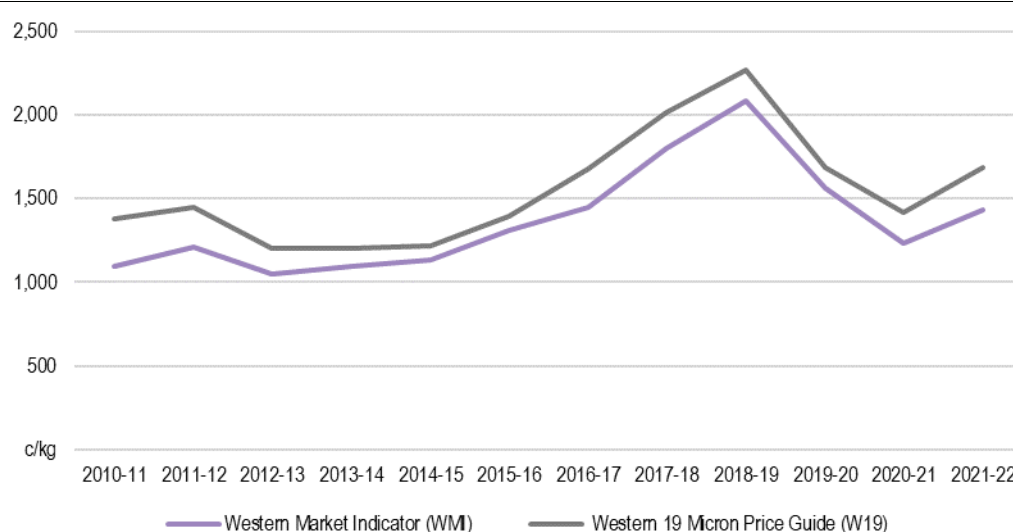
2.6 Market conditions for wool

The wool industry in Western Australia and in Australia more generally has been improving over the last couple of years. For many years prices hovered in a wide band, as wool battled competition with synthetic fibres and Australia invested in product innovation, marketing, and improvement in production. Australia's wool clip has swung towards a greater proportion of fine and super fine Merino wool, now representing 49.3% of the 2021-22 clip, compared with 11 per cent in 1991-92.²⁵

The wool market indicators (Eastern and Western) are a series of benchmarks maintained by the Australian Wool Exchange (AWEX).²⁶ In Western Australia, the key indicator is the Western Market Indicator (WMI) which is expressed in cents per clean kilogram.²⁷

Figure 2.12 displays the tracking of the WMI and the Western 19 Micron Price Guide (W19) (fine wool) since 2010-11.

Figure 2.12 Wool indicator price in Western Australia, 2010-11 to 2021-22



Source: WA Department of Primary Industries and Regional Development, 2023

²⁵ Australian Wool Innovation Ltd (2022), Australian Wool Production Forecast Report, <https://www.wool.com/globalassets/wool/market-intelligence/wool-production-forecasts/australian-wool-production-forecast-report--april-2022.pdf>

²⁶ Wool market indicators are based on fixed baskets of wool types, calculated each sale day. The indicators are economic expressions relating to the current and previous levels of the wool market, some of which are used as the basis for derivative wool market trading.

²⁷ A series of sub-indicators, known as Micron Price Guides, are published for each regional sale day. These are expressed in cents per clean kilogram. Micron (short for micrometre) is wool's mean fibre diameter; the smaller/lower the number, the finer the yarn, and generally the more expensive. Fine wool is considered 19.5 micron or less, with superfine 17.6-18.5, and ultrafine equal to or less than 17.5 micron.



3.1 Economic contribution of the sheep industry

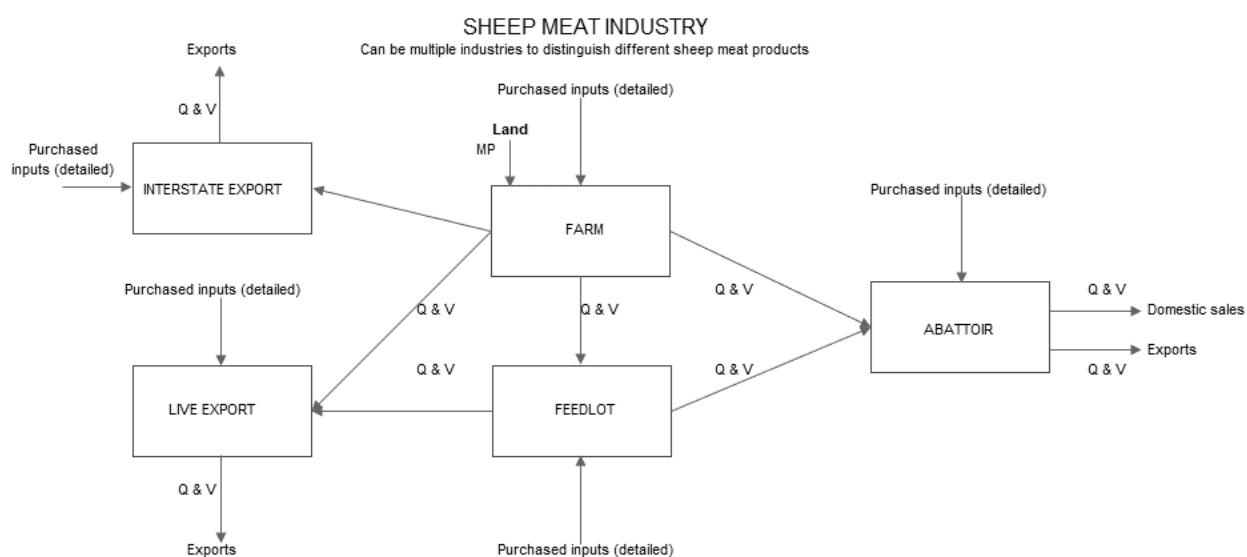
The economic contribution of the sheep industry to the size of the national economy is measured by the impact of the industry on wages, salaries, profits, and indirect taxes. The sheep industry has been separated out into its various components to allow analysis of the contribution of live sheep exports, sheepmeat and wool. The industry has been segmented as follows:

- sheep farming (meat)
- sheep farming (wool)
- sheep feedlot
- sheepmeat abattoir
- live sheep exports (sheep)
- live sheep exports (wool)²⁸
- interstate trade.

The interaction between these segments is present in Figure 3.1 and Figure 3.2 where each block creates a value-added stage (returns to land and capital) that is additive to the value-added impacts calculated from the purchased inputs.

²⁸ Sheep are shorn prior to being shipped and that wool (known as a wool clip) can be sold by live sheep exporters and provides revenue.

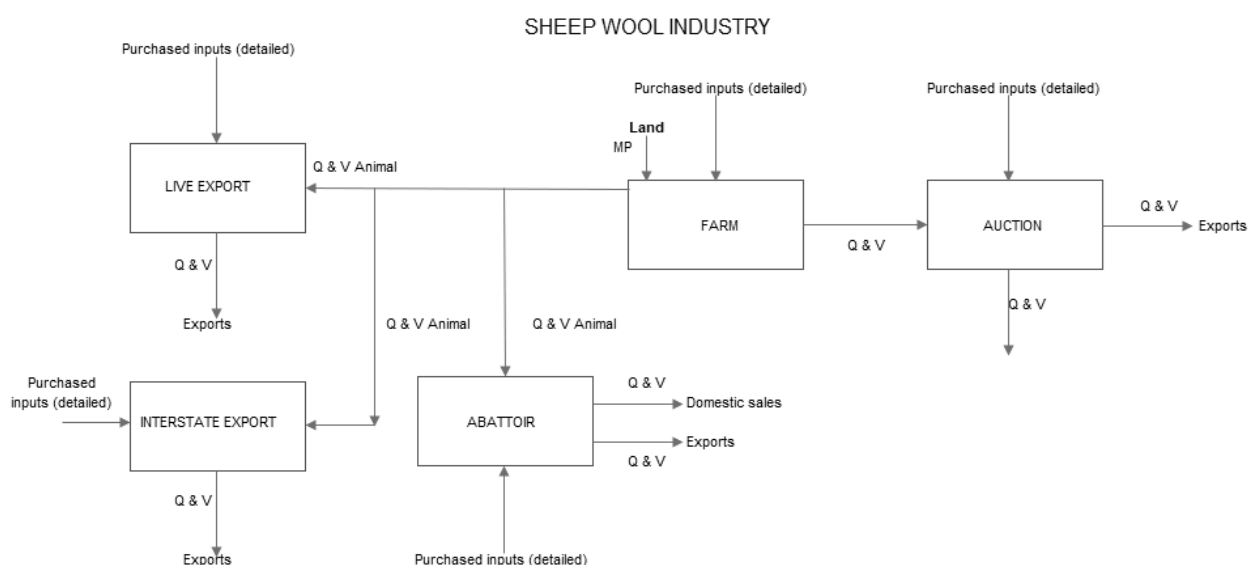
Figure 3.1 Sheepmeat industry



Note: Q = quantity; V = value; Purchased inputs include goods, services and employed labour.

Source: ACIL Allen

Figure 3.2 Sheep wool auction industry



Note: Q = quantity; V = value; Purchased inputs include goods, services and employed labour.

Source: ACIL Allen

Economic contribution extends beyond the direct value added by sheep farms and live exporters to those working in other economic sectors and states. These significant contributions are generated indirectly by the industry’s use of intermediate inputs and increased consumption demand from spending as well as the income (wages and salaries) of those in other industries and regions.

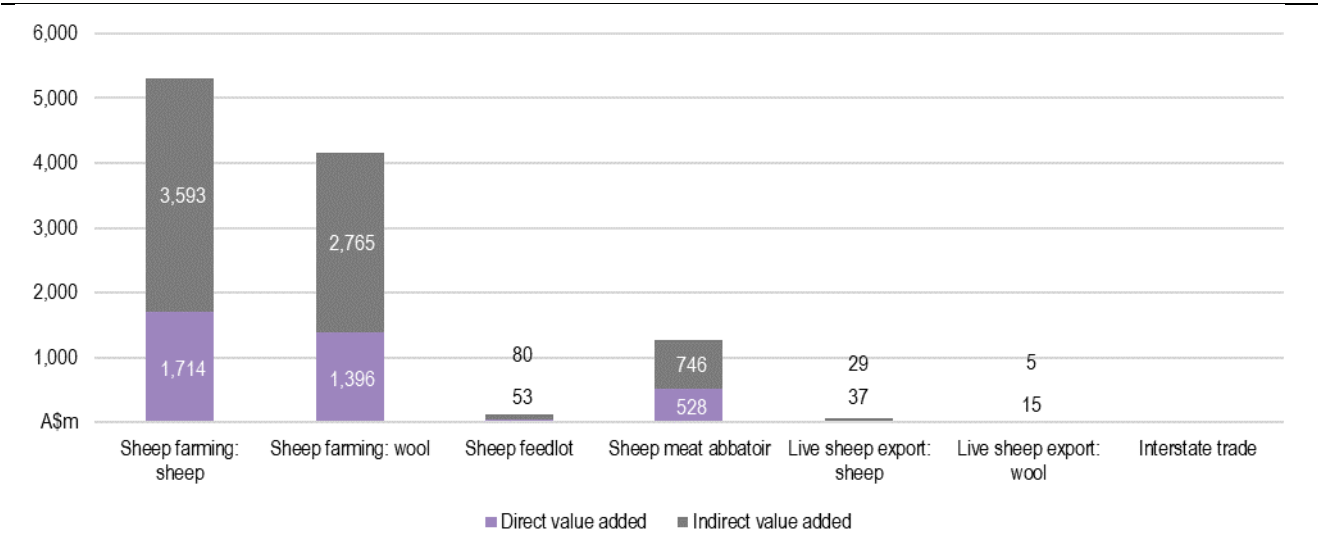
The results are presented as a range (bounds) in the method used (Input-Output analysis). The **lower bound** includes the flow-on effects of live sheep export purchasing from other industries or the direct plus the estimated contribution associated with the supply chain. The **upper bound** estimate then adds the impact of those industries' resulting additional spending (or the consumption-induced effect) to the lower bound associated with direct workers and workers within the supply chain spending the wages and salaries.

- Direct value-added is lower than industry gross value because the value-added includes wages, operating surplus, and taxes and not the other intermediate purchases made in the sheep industry.
- Direct employment is typically those involved in the production of sheep for live export (e.g., producers and live exporters). Indirect employment estimates for live sheep exports are those in related professions often upstream of the farm gate.

3.1.1 National summary statistics

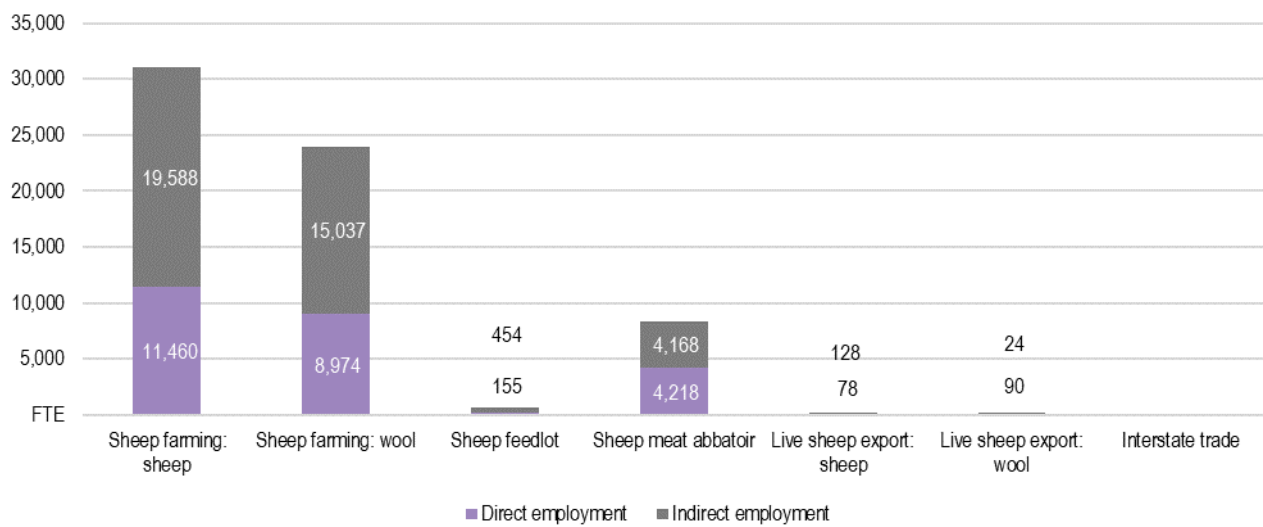
Over the last five years, the Australian sheep industry (including sheep farming (meat and wool), feedlots, abattoirs, live exports (meat and wool) and interstate trade) has on average, **directly** contributed \$3,744.05 million of value added annually and employed 24,975 full time equivalents (FTEs). (Refer Figure 3.3 and Figure 3.4).

Figure 3.3 The Australian sheep industry direct and indirect value-added (five-year average to 2021-22)



Source: ACIL Allen

Figure 3.4 The Australian sheep industry direct and upper bound indirect FTEs (five-year average to 2021-22)



Source: ACIL Allen

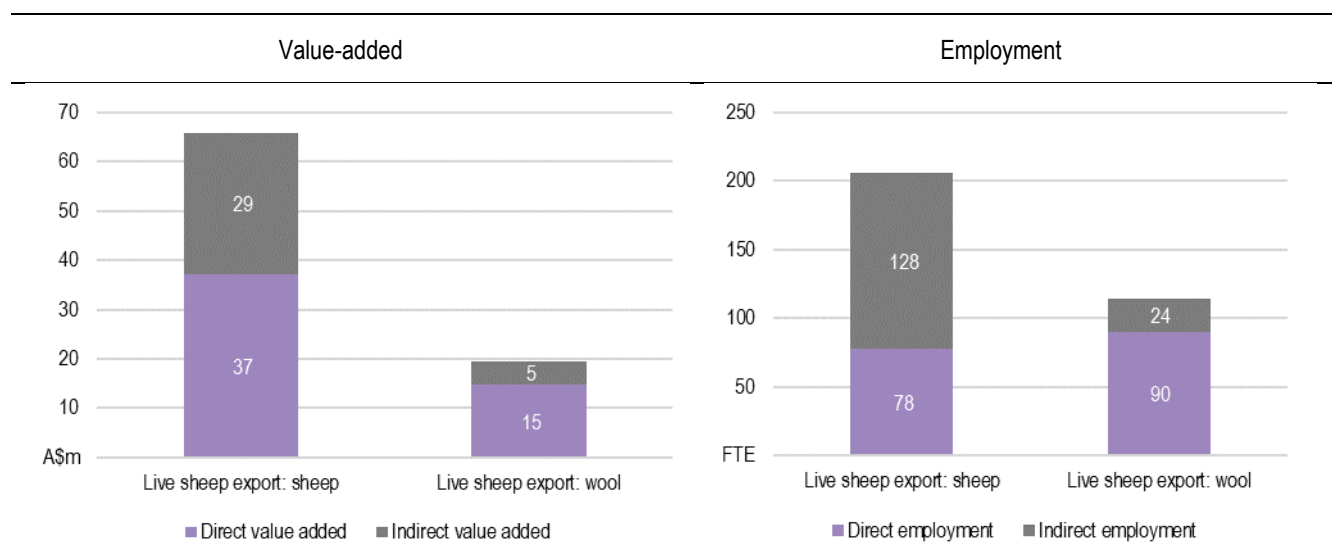
Over the last five years, the live sheep export industry (live sheep and the associated wool clip) has, on average, **directly** contributed \$52 million of value-added²⁹ annually and employed 168 FTEs.³⁰ This is 1.4% of the overall industry value. (Refer Figure 3.5).

Total (indirect plus direct) contribution for the live sheep export industry had an **upper bound** of \$86 million value-added annually and employed 320 FTEs and a **lower bound** of approximately \$74 million and 255 FTEs.

²⁹ Direct value-added is lower than industry gross value because the value-added includes wages, operating surplus and taxes and not the other intermediate purchases made in the sheep industry.

³⁰ This data is based on official Census data and includes anyone who identifies as being employed by the sheep industry including the landholder/producer. As some properties or businesses are more than just sheep producers this number may appear to be lower than numbers reported from other data sources such as industry survey data. For example, a producer may be employed in the sheep industry at less than a full-time equivalent if they spend time employed in other income-generating activities (other farming or non-farming activities).

Figure 3.5 The Australian live sheep export industry total contribution (upper bound) (five-year average to 2021-22)



Source: ACIL Allen

3.1.2 Impact on Western Australia

This section presents the direct and indirect value-added and employment impacts for Western Australia.

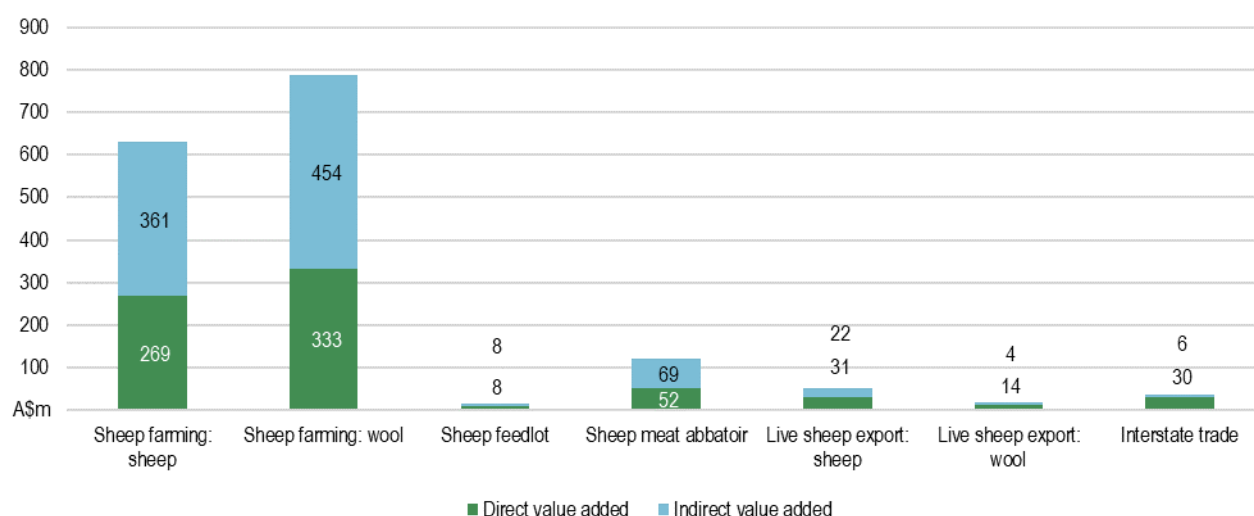
Over the last five years, the Western Australian sheep industry (including sheep farming (meat and wool), feedlots, abattoirs, live exports (meat and wool) and interstate trade) has, on average, **directly** contributed \$737.2 million of value-added annually and employs 4,312 full time equivalents (FTEs). (Refer Figure 3.6 and Figure 3.7).

As Western Australia dominates the market for live sheep exports (93% of live sheep exports over the last five years) the results are very similar to the national contribution but live sheep exports (sheep plus the associated wool clip) account for a higher proportion (6.1%) of the total sheep industry value added in Western Australia than they do nationally (1.4%).

In the last five years, the live sheep export industry in Western Australia (live sheep and the associated wool clip) has, on average, **directly** contributed \$45 million of value-added annually and employed 152 FTEs. (Refer Figure 3.8).

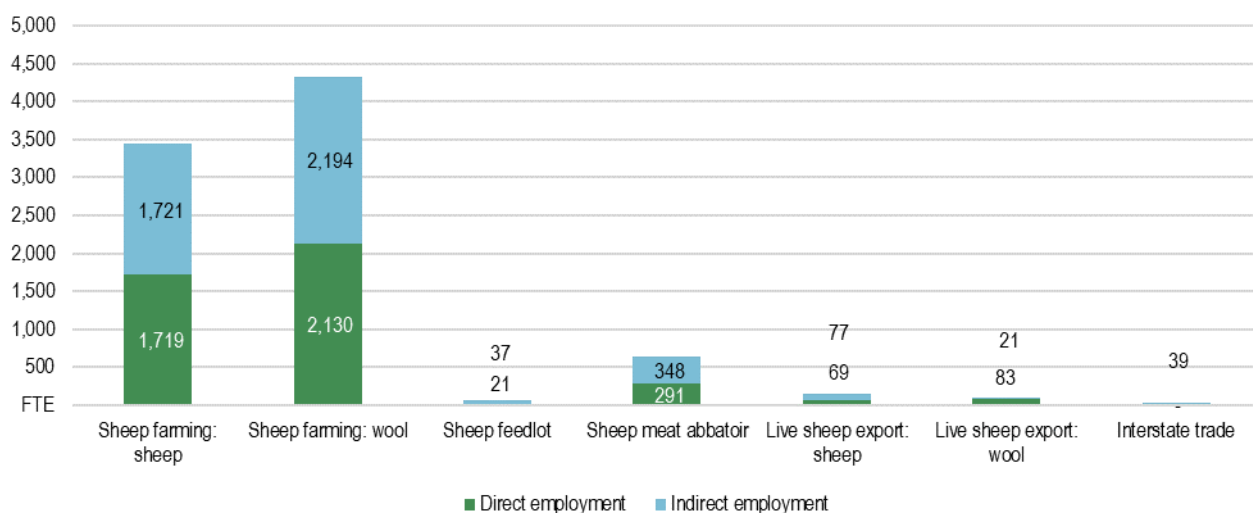
Total (indirect plus direct) contribution for the live sheep export industry had an **upper bound** of \$71 million value-added annually and employed 249 FTEs and a **lower bound** of approximately \$62 million and 200 FTEs.

Figure 3.6 The Western Australian sheep industry direct and indirect value added (five-year average to 2021-22)



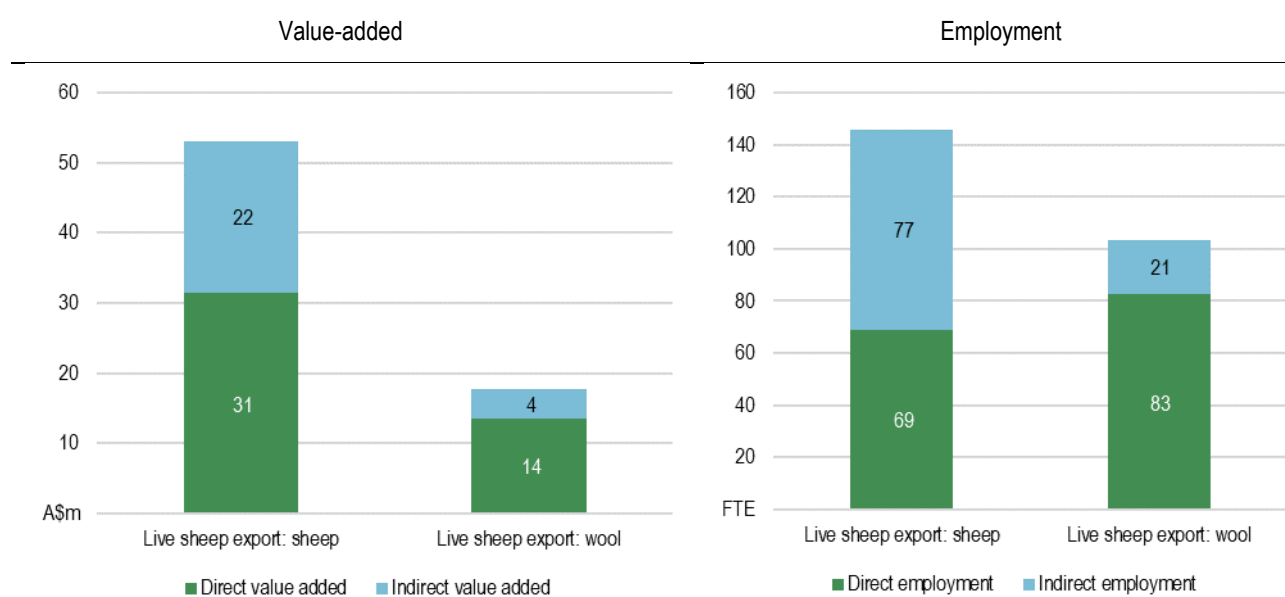
Source: ACIL Allen

Figure 3.7 The Western Australian sheep industry direct and indirect FTEs (five-year average to 2021-22)



Source: ACIL Allen

Figure 3.8 The Western Australian live sheep export industry direct and indirect (upper bound) (five year average to 2021-22)

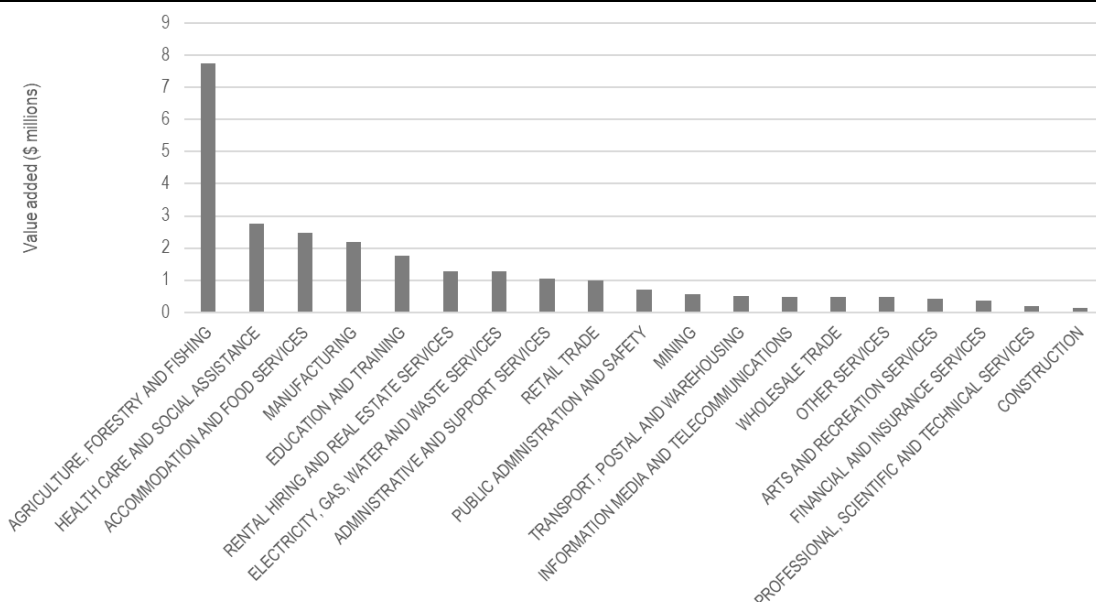


Source: ACIL Allen

Flow on impacts to other industries from live sheep exports

The total (direct plus indirect) upper bounds value added of \$71 million from live sheep exports (live sheep and associated wool clip) are distributed across other industries in the Western Australian economy. Outside the agriculture sector, the largest impacts are seen in health care and social assistance, accommodation and food services, manufacturing and education and training. (Refer Figure 3.9).

Figure 3.9 Total (direct + indirect) value added (\$ millions), upper bounds



Source: ACIL Allen

3.2 Impact of cessation of live sheep exports

Two scenarios are analysed to quantify the impact of the cessation of live sheep exports.

- **Scenario 1:** no change to the current situation (the Merino wether production system 'as is', or business as usual forms the baseline for comparison)
- **Scenario 2:** the immediate cessation of live sheep exports, with and without price responses.

Price responses have been calculated using elasticities calculated from econometric studies (refer Appendix C).

3.2.1 Scenario 1: Business as usual

In Western Australia, sheep flocks are run as part of a mixed farming enterprise. Sheep production systems produce wool, lamb and sheep for slaughter, and lamb and sheep for live export. This means that producers have several alternative and complementary products within their system.

Purebred Merino, the majority of the WA flock (refer Chapter 2), are mainly utilised for wool production. Cross-bred lines are generally used for sheepmeat production. There is a degree of flexibility present, meaning that both crossbred and purebred lines are used for both wool and sheepmeat production. This flexibility is critical to managing risk and operating effectively in the dynamic and seasonal agricultural enterprise.

For both wool and sheepmeat production, most flocks are self-replacing, and Merino ewes remain in the breeding stock until they reach the end of their reproductive life, at which point they are cast for age. Refer Box 2.1 for details on sheep type.

There are four primary expected outcomes for **Merino male sheep** in a typical Merino sheep farming enterprise in Western Australia (refer Figure 3.10):

1. Male lambs are **sold as Merino prime lamb at six to eight months of age**. Merino lines have been bred to optimise wool properties rather than sheepmeat, so the proportion of Merino wethers sold as prime lamb in this age range is limited.
2. Male lambs are **sold into the Merino prime lamb market at 10 to 12 months of age**. Generally, this outcome comprises sheep that are not heavy enough to be sold in the previous six to eight-months. They have often been fed with higher quality pasture and fodder crops to increase weight for slaughter.
3. Sheep that are not initially sold into the Merino prime lamb market are generally **retained for wool production**. Typically, they are held until first shearing and assessed for their wool quality to determine their value to the business. Sheep are kept based on their wool quality and quantity and sometimes based on the state of the flock. For example, flocks in a rebuilding phase (e.g., after a sell-off due to drought) may hold more sheep. Wethers are usually held for wool production if not sold into the Merino prime lamb market.
The value of the sheep is determined by the amount and quality of wool produced, and the state of the flock in general should also be considered. For example, if the flock is in a rebuilding phase, sheep that would otherwise be sold may be held.
4. Those male sheep not retained for wool production are usually **sold into the live export trade or sold for slaughter**.

Due to constant changes in supply, demand, price and environment, producers must consider various factors to decide how to distribute their flock among the four outcomes. These factors include the:

- amount of feed available for grazing, and (if required) the cost of additional feed
- possible impact of forward contracts
- weather outlook for the current and future seasons
- opportunity costs from competing operations. For example, consider an increase in the price of other livestock products or crops, and the effect on the relative value of sheep enterprises.
- condition of the sheep relative to the market specifications of quality.

Figure 3.10 presents a decision tree diagram that examines the points at which sheep are sold or moved to the next node/level.

The model is constructed on a per head basis for all male sheep that are turned-off in the 2021-22 year in the Western Australian flock. Each level represents a different point in time. All sheep begin as lambs and then progress to wether lambs and adult wether sheep.³¹

The final branches are the terminal branches, showing Net Present Value (NPV) for each outcome.

NPV calculations factor in all direct income and expenditure incurred from each individual outcome. The calculation considers the costs of any additional pasture required, health, shearing, crutching and direct labour. The NPV also factors in wool and sheep sale value, meaning all other expenditure and income for outcomes is considered in the NPV calculation. The values at each branch in this decision tree are the NPV and the probability of this event occurring. The outcomes are all combinations of the normal distribution of the sheep within the flock, the seasonal conditions at the time, and a range of other management considerations.

³¹ Although hoggets are a frequently used term in the system and hoggets are a specific class of sheep (refer Box 2.1) for live export (Refer Table 2.3), this model assumes that hoggets are the same as adult sheep.

The proportion attributed to each branch is seen underneath the branch line. These proportions have been determined by making the following assumptions about a Merino wether production system, where:³²

- Level 1: this system emphasises wool production, and as a result, most (90%) wether lambs are retained as light sheep. A small proportion (10%) may make the weight for the trade lamb market and are sold into that market.
- Level 2: At this stage the majority (80%) of sheep are retained at the second chance node due to the emphasis on wool production. Similarly, at this stage, a percentage (20%) are fed to increase weight and sold off in level 3b.
- Level 3a: The majority (80%) of sheep retained for wool in level 2 are also retained for wool in level 3a and are sold for slaughter (90%) or live export (10%) when they reach the end of their productive life producing wool.
- Level 3b: the third chance node consists of lamb sold into the live sheep export market (25%) or slaughter (75%).

Considering the probability and NPV of all outcomes, the expected value of Merino wether lamb in this production system is **\$113.81**.

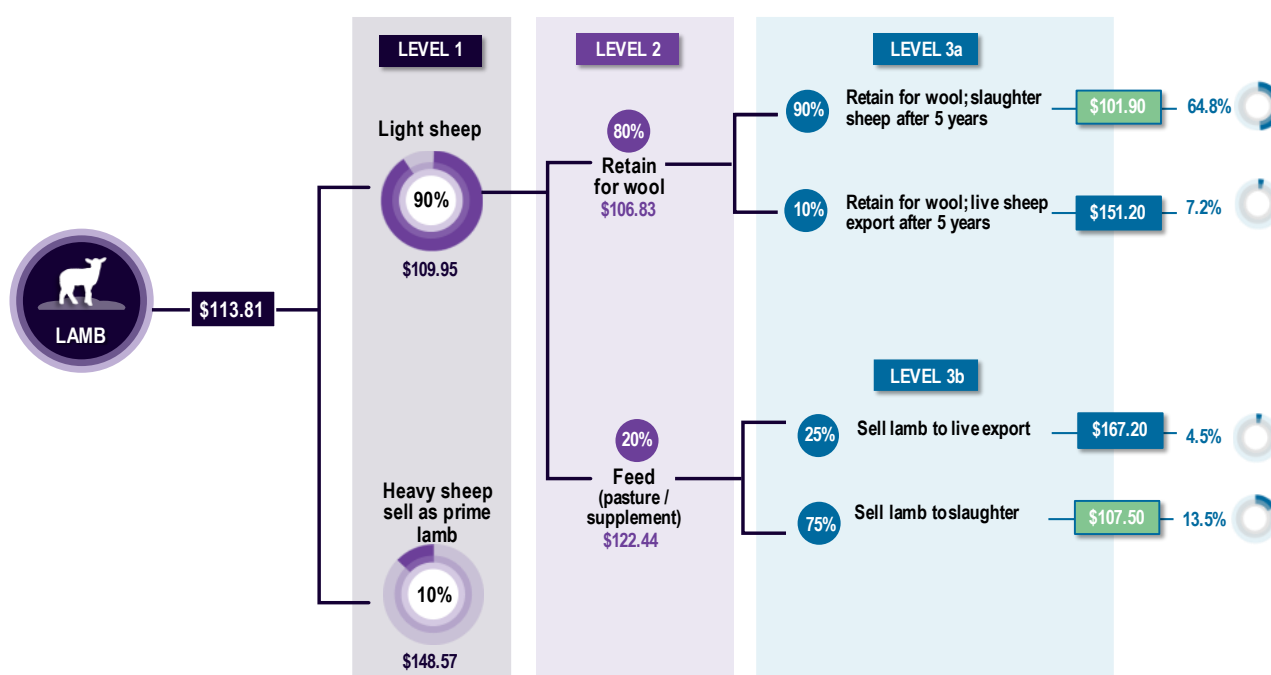
Interpreting the proportions (probability of the event occurring) on the far-right hand side of Figure 3.10 requires consideration of the turn-off statistics for 2021-22 (Refer Table 3.1).

Figure 3.10 shows that 4.5% of all sheep are sold to live export as lambs and 7.2% are sold to live export as adult sheep. This broadly equates to the 11% turned-off to live export in 2021-22 and generally aligns with 40% (4.5% of 11%) wether lambs live exported versus 60% exported as adults and hoggets³³ in 2020 as per Table 2.3.

³² These assumptions are based on discussions in 2017 with stakeholders in the Western Australian sheep industry including discussions with experts such as those running the Model of an Integrated Dryland Agricultural System (MIDAS). There was not time as part of this project to update these assumptions however it is generally believed that there has not been significant change over the last five years.

³³ Although hoggets are a frequently used term in the system and hoggets are a specific class of sheep (refer Box 2.1) for live export (Refer Table 2.3), this model assumes that hoggets are the same as adult sheep.

Figure 3.10 Scenario 1: Business as usual, with live exports for male sheep



Source: ACIL Allen

Table 3.1 Western Australia sheep turn-off (2021-22)

2021-22	Lamb slaughter	Sheep slaughter	Live export	Interstate transfer	Total
Thousands of head	2,508	1,156	487	268	4,419
%	57%	26%	11%	6%	100%

Source: ACIL Allen with data from WA Department of Primary Industries and Regional Development, 2023

3.2.2 Scenario 2: the impact of cessation of the live sheep trade

In this scenario, for the purpose of economic analysis, it is assumed that there is no time for the industry to adjust resources, and the scenario is analysed without and with price responses.

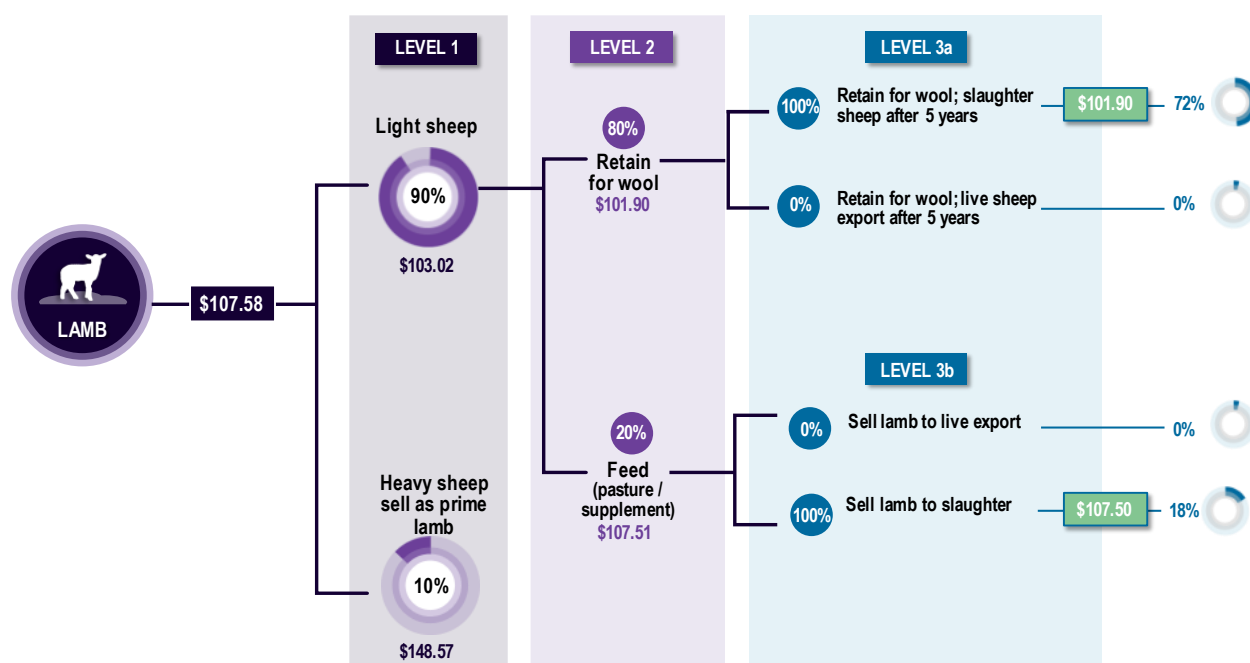
The decision tree in Figure 3.11 shows the same scenario as presented in Figure 3.10, except that in this scenario there is no option to sell into the live sheep export market. As a result, the proportions for live export are zero.

In this scenario, the expected value of the Merino wether lamb in this system is **\$107.58**.

Compared to the NPV in Scenario 1, in which live export was an option, the NPV in this scenario is **\$6.24 or 5.48% less**. The value of the producer's option to sell sheep to live export is worth **\$6.24 per wether**.

The NPV calculations from Figure 3.11 do not consider any movement in prices at the abattoir due to a sudden change in supply.

Figure 3.11 Scenario 2: Cessation of live sheep exports (no price response), for male sheep



Source: ACIL Allen

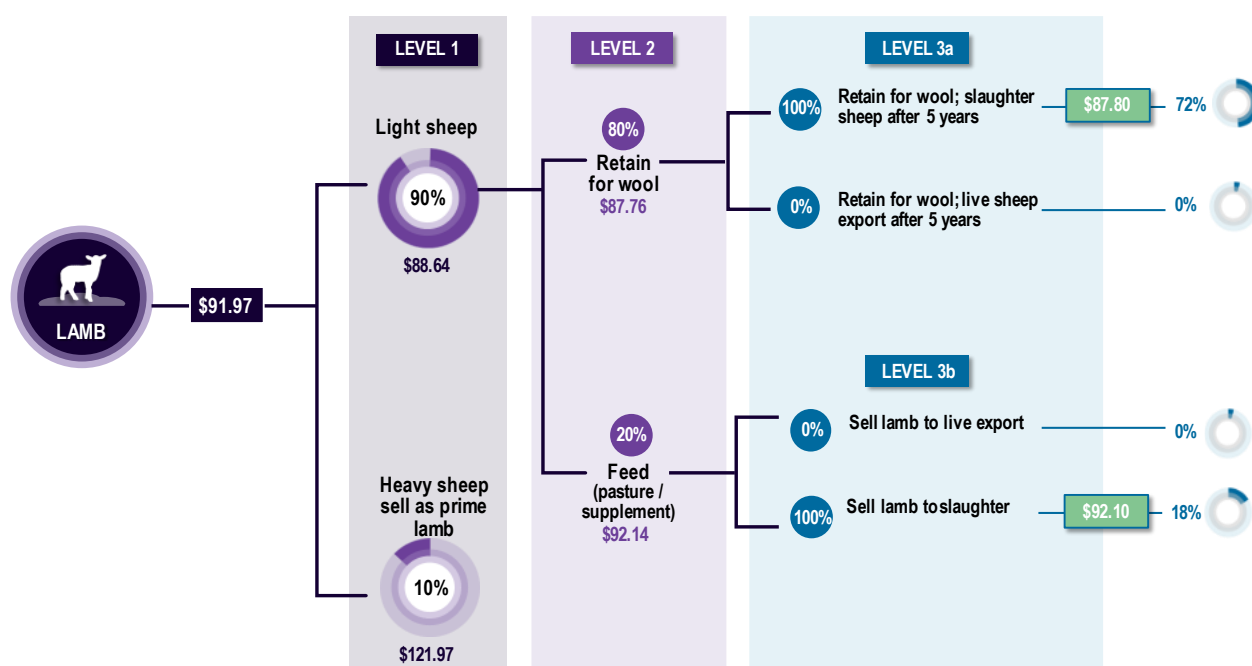
The value of the producer's option to deliver sheep to live export is \$21.84 per wether in the Merino production system with a price response.

However, domestic prices paid for animals can respond quickly to market changes, and it can be expected that an increase in supply created by the cessation of live sheep exports would likely put downward pressure on prices paid. Figure 3.12 includes price responsiveness to estimate the potential impact on price return to producers. Discussion around these elasticities and the sensitivity of the analysis to the elasticity values can be found in Appendix C. Accounting for potential price impacts of a sudden cessation, reduces the NPV value to \$91.97. This is a difference of **\$21.84 (19.19%) less**, than in Scenario 1 (business as usual), where live export is an alternative.

It can be hypothesised that if the cessation were to occur during a period of high supply and low demand, the price response would likely be more pronounced. This implies a higher elasticity of demand, indicating that the market is more sensitive to changes in supply. In this scenario, using the higher elasticity point as a reference, it is estimated that the net present value (NPV) loss could potentially amount to as much as \$37.44 (32.90%). This estimation suggests that the impact of the

surge in supply on prices and overall profitability could be significant under the given market conditions.

Figure 3.12 Scenario 2: Cessation of live sheep exports (with price response), for male sheep



Source: ACIL Allen

3.3 Markets and trade

This analysis focuses on a subset of five MENA countries, Israel, Jordan, Kuwait, Oman, and the United Arab Emirates (UAE) as the largest importers of Australian sheep in recent years.

Limited livestock production, particularly at scale,³⁴ coupled with the cultural significance of sheep and sheepmeat means the MENA region is a large importer of both live sheep and sheepmeat products. Appendix A provides a socio-economic profile of each of these countries.

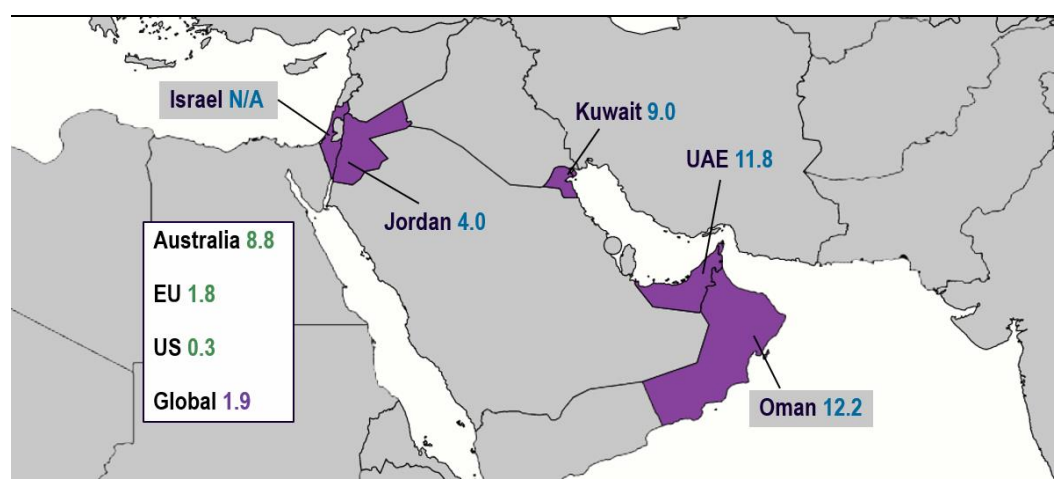
The importance of sheep and sheepmeat can be seen in the region's per capita consumption, which is significantly higher than the global average of 1.9kg (2018).³⁵ (Refer Figure 3.13). The average Oman citizen consumed 12.2kg carcass weight equivalent (cwe) of sheepmeat in 2021, followed by the UAE (11.9kg cwe), Kuwait (9kg cwe), and Jordan (4kg cwe).³⁶ In comparison, Australia consumes 8.8kg cwe and the per capita consumption is considerably lower in the EU (1.8kg cwe) and US (0.3kg cwe).³⁷

³⁴ LiveCorp, *Ruminations – Stories of Live Export, November 2021*, accessed 18 April 2023

³⁵ Food and Agriculture Organization (FAO), *OECD-FAO Agricultural Outlook 2015, Sheepmeat consumption, Projection per capita*, accessed 11 April 2023, https://www.oecd-ilibrary.org/sheep-meat-projections-consumption-per-capita_5jrxx434l23.pdf?itemId=%2Fcontent%2Fcomponent%2Fagr_outlook-2015-table144-en&mimeType=pdf

³⁶ Data for Israel is not available.

³⁷ Food and Agriculture Organization (FAO), *OECD-FAO Agricultural Outlook 2015, Sheepmeat consumption, Projection per capita*, accessed 11 April 2023, https://www.oecd-ilibrary.org/sheep-meat-projections-consumption-per-capita_5jrxx434l23.pdf?itemId=%2Fcontent%2Fcomponent%2Fagr_outlook-2015-table144-en&mimeType=pdf

Figure 3.13 Per capita sheepmeat consumption in MENA countries, 2021 (kg cwe/capita/year)

Note: Data for Israel is not available.

MENA countries' figures are in 2020-21 financial year, other countries' figures are 2024 projections

Source: ACIL Allen based on *Meat & Livestock Australia, MENA Beef & Sheep meat Snapshot, 2021 and projections from United Nations' Food and Agriculture Organisation, 2015*

3.3.1 Cultural importance of sheep and sheepmeat in MENA

Sheep have played a vital role in the region's culture, religion, and traditions throughout a history spanning thousands of years, and sheepmeat remains one of the most widely consumed sources of protein in the Middle East.

There is a clear demand for fresh (also known as 'hot')³⁸ meat in the Middle East. The Australian Livestock Exporters' Council report that citizens in MENA countries prefer 'hot' meat as "they slaughter the animal in the morning and will eat that at lunch time or at the latest at dinner"³⁹.

Countries in the Middle East have a preference for live sheep due to several factors:

- **Cultural and religious traditions:** The Middle East has a long-standing cultural and religious tradition that includes the sacrifice of live animals during religious festivals and occasions. Live sheep are an integral part of these traditions, and the ability to select and sacrifice the animal themselves hold cultural and religious significance.
- **Freshness and quality control:** The preference for live sheep allows individuals to personally inspect the animal before purchase, ensuring freshness and quality. This gives consumers confidence in the health and condition of the animal, as they can assess factors such as the animal's weight, appearance, and overall well-being.
- **Customised butchering and preparation:** By opting for live sheep, individuals have control over how the animal is butchered and prepared according to their specific requirements and preferences. This allows for the customisation of cuts and portions, ensuring that the meat is prepared in a manner that suits their cultural and culinary traditions.
- **Taste and texture:** Some individuals believe that freshly slaughtered and prepared meat from live sheep provides a superior taste and texture compared to pre-packaged or frozen meat.

³⁸ Refers to meat that is freshly or recently killed and not chilled.

³⁹ Senate Select Committee on Animal Welfare, (1985) *Export of Live Sheep from Australia*, accessed 4 April 2023
https://www.aph.gov.au/parliamentary_business/committees/senate/significant_reports/animalwelfarectte/exporthivesheep/index

The immediacy of the slaughter and preparation process is believed to contribute to the overall quality, tenderness and flavour of the meat.

- **Familiarity and connection to tradition:** The preference for live sheep in the Middle East may also be influenced by the familiarity and connection to traditional practices. Live sheep have been an integral part of Middle Eastern culture for generations, and the continuation of these practices maintains a sense of cultural identity and heritage.

It's important to note that these preferences may vary among individuals and communities within the Middle East. While live sheep are favoured by many, there is also a demand for processed sheepmeat that caters to different consumer preferences and convenience.

The below excerpt describes the significance of sheepmeat as part of food culture in the region:

The meat of sheep is the most popular in the Near and Middle Eastern and North African cuisine. A lamb is slaughtered on special occasions like a wedding, birth of a child or circumcisions...Often families buy one or two lambs before a festival and fatten them in anticipation. Often, half of a slaughtered lamb is given to the poor. So by this a family is observing the commands of God...Normally, the meat of a lamb of about one year of age is used, because of the quantity of fat and the quality of taste...all eatable parts of the lamb are used.

Heine, P., 2004. Food Culture in the Near East, Middle East and North Africa, Greenwood Publishing, p 42.

The role of sheep in religion

Sheep play an important role in Islam. During the annual Hajj pilgrimage to Mecca, Muslims are required to sacrifice an animal, typically a sheep or goat, as part of the Eid al-Adha festival. This is meant to commemorate the story of Ibrahim (Abraham) and his willingness to sacrifice his son for the sake of God.⁴⁰

The sacrifice of a live animal is seen as an expression of faith, gratitude, community solidarity; an act of devotion and generosity. It is deeply ingrained in the cultural and religious identity of many people in the region.⁴¹

Sheep in broader culture and tradition

From a cultural perspective, sheep are seen as symbols of hospitality, generosity, and kindness. It is not uncommon for Middle Eastern families to keep sheep on their properties, especially in rural areas. In many cases, guests are greeted with the sight of sheep grazing in the yard, and it is considered a sign of respect and honour to offer a guest a sheep as a gift or as a meal.⁴²

Sheep also feature prominently in cultural and social traditions, such as weddings, feasts, and community gatherings. The rearing and care of sheep are often part of the rural lifestyle, fostering a connection between communities and their livestock.

The cultural importance of live sheep in the Middle East can also be seen in traditional festivals and events featuring sheep, such as the Oman National Sheep Show.⁴³ These events showcase the

⁴⁰ Franck, A. et al (2016). Blood and the City, Anthropology of the Middle East, 11(1), pp 85-111.

⁴¹ Peters, F. E. (1994). The Hajj: The Muslim Pilgrimage to Mecca and the Holy Places. Princeton University Press.

⁴² Seegers, J. L. (1991). Sheep and Goat Production in the Near East. FAO Animal Production and Health Paper No. 88. Food and Agriculture Organization of the United Nations.

⁴³ See: <https://gulfnews.com/world/gulf/oman/omanis-flood-habta-livestock-markets-on-eid-1.2269102>

region's cultural heritage and celebrate the role that sheep play in the daily lives and traditions of many Middle Eastern communities.

This practice is so embedded and prolific that the Government of Saudi Arabia, for example, has established local government slaughterhouses where people can take animals to be slaughtered to maintain food safety and hygiene. Many countries, especially Kuwait, emphasise locally slaughtered meat rather than the consumption of frozen or chilled meat. Kuwait maintains that despite any religious practices, the slaughtering of sheep helps to “teach our [their] children about what they’re eating and to thank God for it, so they understand and show respect to what they consume” (The CEO of the Kuwait Livestock Transport and Trading Company (KLTT)).⁴⁴ Box 3.1 shows this sentiment has not changed over time.

Box 3.1 Case study –Al Mawashi – Kidzania Kuwait partnership

Al Mawashi is a Kuwaiti livestock trading company that specialises in the export of sheep and other livestock to various countries around the world. The company was founded in 1978 and has since become one of the largest exporters of live sheep in the world.

Al Mawashi has its own fleet of specialised livestock carriers, which are equipped with advanced facilities to ensure the comfort and well-being of the animals during transport. The company also has its own quarantine and holding facilities, where the animals are kept before and after shipment to ensure that they are healthy and fit for transport.

In addition to exporting live sheep, Al Mawashi also offers a range of other services, including the import and distribution of frozen and chilled meat products, the provision of animal feed and veterinary services, and the development of livestock production projects.

In 2018, KidZania, in partnership with Al Mawashi, was opened in Kuwait. The vision was to enrich children's learning experience about meat processing and the livestock industry. Al Mawashi has embedded two separate establishments in KidZania:

- Learning about meat processing and production in a simulated meat factory
- Opting to become a veterinarian, engine room engineer, or captain of a ship that transports livestock from Australia to Kuwait.

KidZania, a Mexican concept established in 1999, provides facilities for children and offers a range of experiences that are relevant to each region, culture, and geography by way of professions, entertainment and food and uses real-world fun and learning through role-playing, to help prepare children for their future.

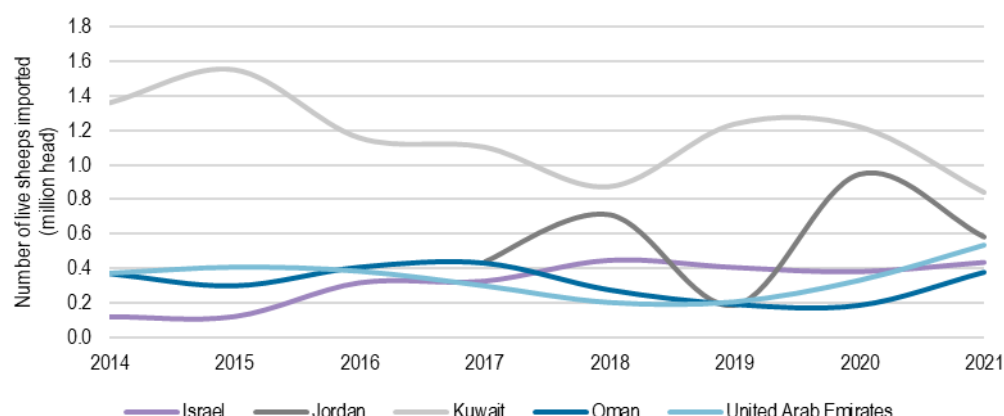
Source: Various including <https://kidzania.com/en/index>; <https://almawashi.com.kw/news-&-media/news-single-story/kidzania-partner-with-al-mawashi> and <https://almawashi.com.kw/>

3.3.2 The global market for live sheep in MENA

Figure 3.14 shows the estimated total number of live sheep imported by the five MENA countries of focus from all suppliers. In 2021, Kuwait imported the most live sheep (approximately 837,000 head), followed by Jordan (585,000), the UAE (532,000), Israel (535,000), and Oman (378,000).

The trends show that the number of live sheep imported by Kuwait has decreased significantly since 2015, while Jordan has been increasing numbers since 2019.

⁴⁴ LiveCorp, *Ruminations – Stories of Live Export*, November 2021, accessed 18 April 2023

Figure 3.14 Estimated number of live sheep imported by calendar year, 2014-2021

Note: Data for Jordan prior to 2017 is not included due to potential errors.

Source: ACIL Allen based on United Nation's Food and Agriculture Organisation, 2023

Market share

Australia dominates the live sheep trade in the region; however, several other countries also export live sheep into the Middle East. Eastern Europe and MENA-adjacent countries are among the world's top live sheep exporters.

ACIL Allen's analysis based on data from the United Nations' Food and Agriculture Organization (FAO) shows that Australia is consistently in the top countries exporting live sheep to the five countries of focus (see Table 3.2).⁴⁵ The ranking is based on the total gross import of numbers of live sheep between 2017 and 2021.

Table 3.2 Ranking of gross total top live sheep exporters to selected MENA countries (head), 2017-2021

Ranking	Israel	Jordan	Kuwait	Oman	UAE
1 st	Portugal	Romania	Australia	Somalia	Australia
2 nd	Australia	Spain	Jordan	Australia	Somalia
3 rd	Romania	Australia	Iran	Sudan	India
4 th	Serbia	Ukraine	Saudi Arabia	Iran	Iran
5 th	Hungary	France	South Africa	UAE	Jordan

Note: FAO data includes estimates and unofficial figures

Source: ACIL Allen based on United Nation's Food and Agriculture Organisation, 2021

Within the region, there is also significant trade of live sheep.⁴⁶ Jordan, Iran, and Saudi Arabia are the largest exporters of live sheep to regional partners (see Table 3.3). The ranking is based on the total gross export of numbers of live sheep between 2017 and 2021.

The inter-regional trade of live sheep is growing due to non-MENA countries reducing their trading of live sheep to and from MENA countries. To limit the amount of informal live sheep trading, countries like the UAE have made policies and alliances with other MENA countries to facilitate

⁴⁵ FAO data is not suitable for a more in-depth analysis as it contains estimates and unofficial figures.

⁴⁶ Australian sheep are not permitted to be traded to a third party under ESCAS. Refer Box 2.3.

safe, and formal live sheep imports and exports.⁴⁷ Kuwait has engaged in inter-regional live sheep trade to keep their industry alive, as it is 'vital'⁴⁸ to the culture and economy.

Table 3.3 Ranking of gross total top live sheep exporters inter-regionally (all MENA countries) (head), 2017-2021

Ranking	Israel	Jordan	Kuwait	Oman	UAE
1 st	Jordan	Saudi Arabia	Jordan	Iran	Iran
2 nd	-	Israel	Iran	UAE	Jordan
3 rd	-	-	Saudi Arabia	Saudi Arabia	Lebanon
4 th	-	-	Lebanon	Yemen	Saudi Arabia
5 th	-	-	Oman	-	Kuwait

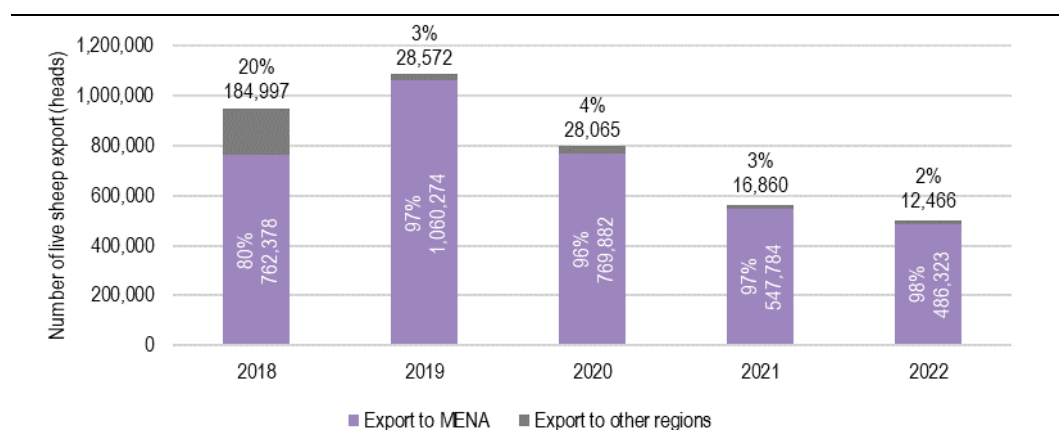
Note: FAO data includes estimates and unofficial figures

Source: ACIL Allen based on United Nation's Food and Agriculture Organisation, 2021

3.3.3 Australian live sheep exports to MENA

In 2018, 80% of live sheep exported from Western Australia went to all countries in MENA (refer Figure 3.15). By 2019, 97% of all live sheep from Western Australia were exported to MENA, with most of the remaining 3% airfreighted to Malaysia. This trend has remained over the last few years, although the total number of live sheep being exported has declined due to a combination of factors including increased regulatory costs, changes in domestic sheep prices meaning an increase in transfer of sheep to eastern states, relatively higher prices for Australian sheep than other suppliers, and the COVID-19 pandemic. By 2022, live sheep export numbers were at record lows, with nearly all being exported to MENA countries.

Figure 3.15 Live sheep export from Western Australia to all MENA countries by calendar year, 2018-2022

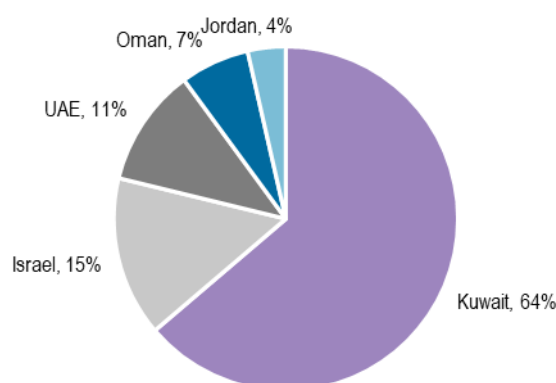


Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, February 2023

With a focus on 2022, and the five countries presented in this study, 64% (290,000 head) of Australia's live sheep exports went to Kuwait, followed by Israel at 15% (69,000 head), the UAE 11% (51,000 head), Oman 7% (30,000 head), and Jordan 4% (17,000 head) (refer Figure 3.16).

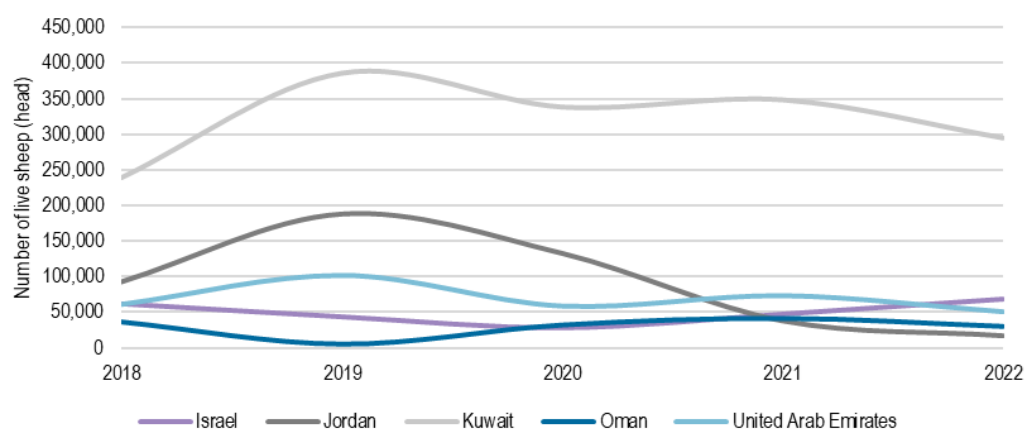
⁴⁷ Interafrican Bureau for Animal Resources, *Inter-Regional Conference to Promote Safe and Stable Livestock Trade Between the Horn of Africa and the Middle East*, accessed 27 April 2023. <https://www.au-ibar.org/au-ibar-communique/communique-inter-regional-conference-promote-safe-and-stable-livestock-trade>

⁴⁸ Australian Financial Review, *Kuwait says live sheep trade vital as producers turn on Albanese*, accessed 27 April 2023. <https://www.afr.com/companies/agriculture/kuwait-says-live-sheep-trade-vital-as-producers-turn-on-albanese-20230317-p5ct3y>

Figure 3.16 Relative share of Australia's live sheep exports to selected MENA countries, 2022

Source: ACIL Allen based on Meat & Livestock Australia, 2023

While the total number of live sheep being exported has declined over the last five years, the exports to certain countries have been increasing in this period (specifically Oman and Israel). Exports to Kuwait and the UAE have slightly decreased since 2019, and exports to Jordan significantly decreased (by 24%) since 2019 (see Figure 3.17). Jordan has primarily reduced imports of Australian sheep due to price, preferring to source from Romania (refer Table 3.2).⁴⁹

Figure 3.17 Australia's live sheep exports to selected MENA countries (calendar year, 2018-2022)

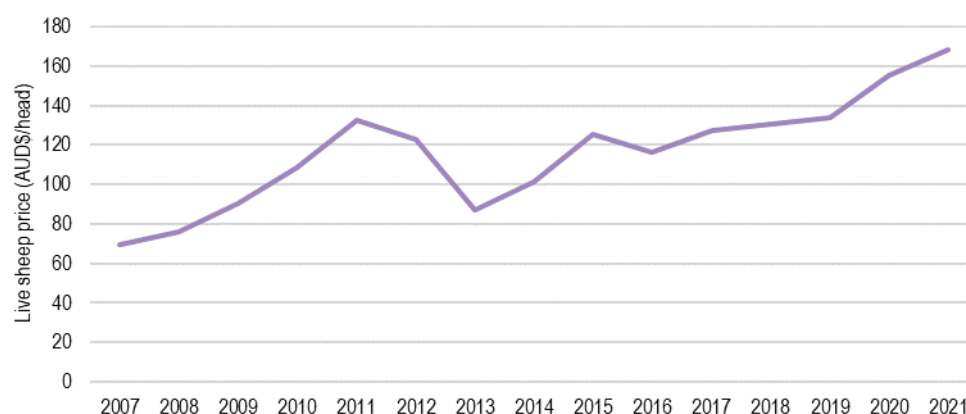
Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, February 2023

⁴⁹ Meat & Livestock Australia 2019, *Sheep export market evolving*, accessed 7 April 2023, <https://www.mla.com.au/prices-markets/market-news/2019/sheep-export-market-evolving/>

3.3.4 Price of live sheep

While data on live sheep prices is limited, ACIL Allen's analysis using data from Western Australian Department of Primary Industries and Regional Development shows that the average export price in 2021 was AUD\$168/head.^{50, 51} Using the Western Australia price from 2021, and the total number of live sheep exported from Western Australia indicates the changes in value for the industry over time. Refer Figure 3.18.

Figure 3.18 Estimated value of sheep being sent to live export (Western Australia)



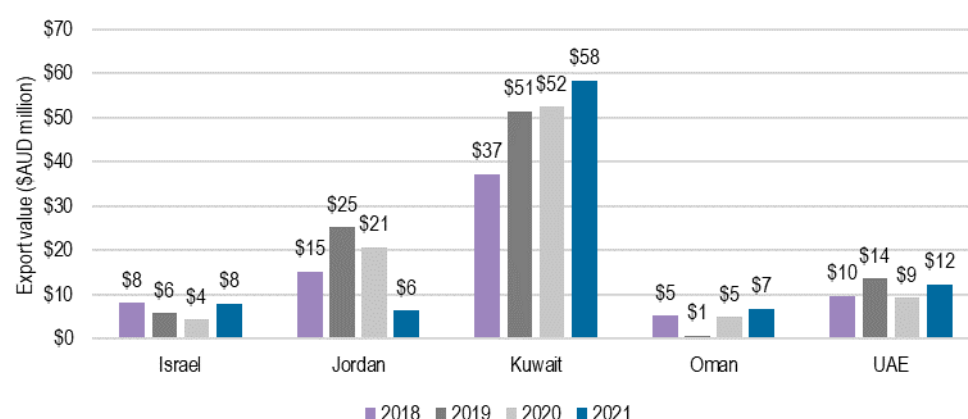
Price is calculated by dividing value to volume of live sheep exported.

Source: ACIL Allen based on Department of Primary Industries and Regional Development, 2023

Using the estimated price of live sheep and export volume data, it was calculated that Australia exported AUD\$92 million worth of live sheep to the five MENA countries in 2021, a 21% increase from AUD\$75.7 million in 2018. Refer Figure 3.19.

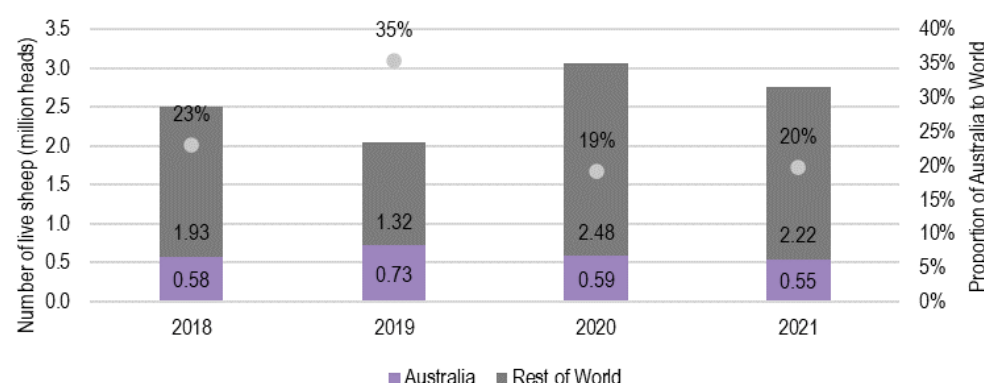
⁵⁰ Department of Primary Industries and Regional Development 2023, *The Western Australian sheep and wool industries*, accessed 24 April 2023, <https://www.agric.wa.gov.au/sheep/western-australian-sheep-and-wool-industries>. This price is fairly consistent with data from Meat & Livestock Australia (2021), where results show the 2020-21 financial year export price of AUD\$148.05/head.

⁵¹ Based on Meat & Livestock Australia, 2021. Total live sheep export value of AUD\$84.5 million, 570,729 head of live sheep exported to Kuwait, UAE, Jordan, Israel, Oman, and Qatar.

Figure 3.19 Estimated live sheep export value from Australia to selected MENA countries, 2018-2021

Source: ACIL Allen based on Department of Primary Industries and Regional Development and Department of Agriculture, Fisheries and Forestry, 2023

Figure 3.20 estimates the Australian versus the rest of the world share of live sheep trade to the five MENA countries of focus and shows that the Australian market share ranges between 19% and 35% from 2018 to 2021.

Figure 3.20 Number of live sheep imported from Australia and rest of world by the MENA countries of focus (blue dots indicate Australian share)

Source: ACIL Allen based on United Nation's Food and Agriculture Organization, 2021

More recent data shows that price of live sheep varies greatly between country and the source of sheep. A selection of available live sheep prices in MENA countries is shown in Table 3.4. The price of live Australian sheep is only available in the UAE, and ranges from \$275 to \$392 per head (2022). This is marginally higher than Somali sheep, but lower than local sheep. The same pattern can be observed in Jordan, where imported Australian sheep are sold for nearly double the price of Somali sheep, indicating that Somali sheep tend to be cheaper in the region.

Table 3.4 Live sheep prices in selected MENA countries, 2022

Country	Type of sheep	Price (USD)	Price (AUD)
Israel	N/A	N/A	N/A
Jordan	Non-Somali sheep	\$190	\$274
	Somali sheep	\$92 - \$105	\$133 - \$151

Country	Type of sheep	Price (USD)	Price (AUD)
Kuwait	N/A	N/A	N/A
Oman	Local sheep	\$299 - \$351	\$431 - \$506
United Arab Emirates	Australian sheep	\$191 - \$272	\$275 - \$392
	Somali sheep	\$181 - \$177	\$261 - \$255
	Local sheep	\$408 - \$680	\$588 - \$980

Note: USD to AUD conversion used the average 2022 exchange rate of 1.442.

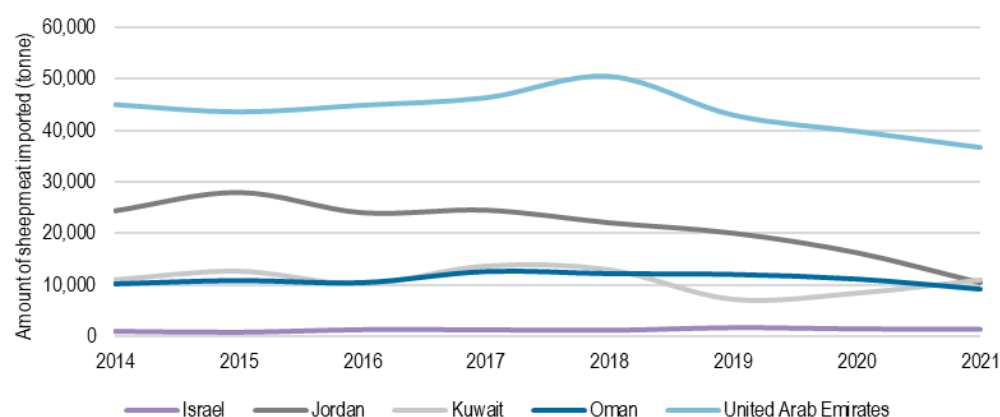
Source: ACIL Allen based on data provided by the Livestock Export Program, 2022

3.3.5 The market for sheepmeat in selected MENA countries

In 2021, the UAE imported the most sheepmeat (approximately 36,000 tonnes), followed by Kuwait, Jordan, and Oman. Israel imported the least with just under 1,400 tonnes. Although sheepmeat imports to all MENA countries have remained steady since 2014, there have been decreasing trends in the five focus countries in recent years. Jordan has seen the biggest annual average decline (10% since 2015). Refer Figure 3.21.

Reasons for this decline include changes in economic conditions, increased transport costs and the COVID-19 pandemic.⁵² However, demand for sheepmeat in these countries is forecast to increase at 8.7% compound annual growth rate, driven by economic recovery, particularly growth in tourism and population growth.⁵³ The latest figures show that in 2021-22, the whole MENA region imported approximately 105,000 tonnes of sheepmeat globally, a 7% increase from the previous year, further supporting this forecast.⁵⁴

Figure 3.21 Estimated amount of sheepmeat imported by calendar year for selected MENA countries, 2014-2021



Source: ACIL Allen based on United Nation's Food and Agriculture Organization, 2023

Market share

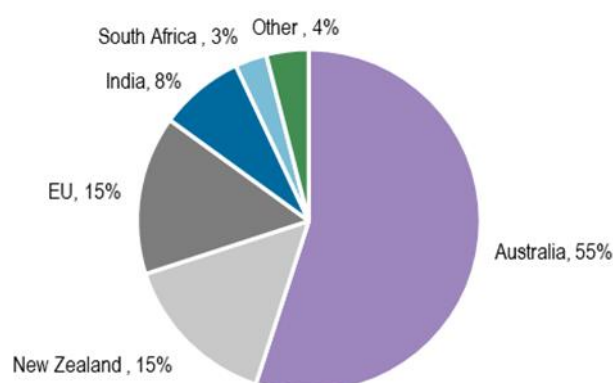
In the 2021-22 financial year, Australia was the dominant supplier (55%) of sheepmeat into all of MENA. New Zealand and the EU had 15% each, followed by India (8%), and South Africa (3%). Refer Figure 3.22). While New Zealand is generally seen as a major competitor of Australia, the majority of sheepmeat from New Zealand is exported to China and European countries instead of MENA.⁵⁵

⁵² Meat & Livestock Australia 2021, *MENA Beef and Sheepmeat Snapshot*, accessed 6 April 2023

⁵³ Ibid.

⁵⁴ Meat & Livestock Australia 2022, *Global sheepmeat industry and trade report*, accessed 11 April 2023, <https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/mla-mi-global-industry-trade-report-sheep.pdf>

⁵⁵ Meat & Livestock Australia 2022, *Global sheepmeat industry and trade report*, accessed 11 April 2023, <https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/mla-mi-global-industry-trade-report-sheep.pdf>

Figure 3.22 Global share of sheepmeat export to MENA region, 2021-22 financial year

Source: ACIL Allen based on Meat & Livestock Australia, 2022

Table 3.5 shows the ranking of top sheepmeat exporters to the five MENA countries of focus based on FAO data. Australia is the biggest exporter (by a large margin) except for Israel. Other significant exporters include New Zealand, the EU (Spain and Romania), and India. The ranking is based on the total gross tonnes of sheepmeat between 2017 and 2021.

Table 3.5 Ranking of gross total sheepmeat exporters to selected MENA countries (tonnes), 2017-2021

Ranking	Israel	Jordan	Kuwait	Oman	UAE
1 st	Spain	Australia	Australia	Australia	Australia
2 nd	Australia	New Zealand	Spain	UAE	India
3 rd	Chile	Romania	New Zealand	New Zealand	Pakistan
4 th	Argentina	United Kingdom	India	India	Spain
5 th	France	Sudan	Romania	China	New Zealand

Note: FAO data includes estimates and unofficial figures

Source: ACIL Allen based on United Nation's Food and Agriculture Organization, 2021

In terms of inter-regional trade (refer Table 3.6), the UAE and Saudi Arabia are dominant regional suppliers. The ranking is based on the total gross tonnes of sheepmeat between 2017 and 2021.

Inter-regional sheepmeat trade amongst MENA countries has been established to ensure that the livestock and meat traded is safe and sustainable. In 2020, the Food and Agriculture Organization of the United Nations (FAO) and the IGAD Center for Pastoral Areas and Livestock Development (ICPALD) set up systems to enhance inter-regional trade between MENA and the Gulf countries.⁵⁶ This was primarily to aid the major actors in the meat value chain and ensure higher standards of hygiene and cross-border cooperation.

⁵⁶ Food and Agriculture Organization of The United Nations, *FAO and IGAD step towards improving livestock trade between IGAD and the Middle East and Gulf (MENA) Regions*, accessed 27 April 2023. <https://www.fao.org/africa/news/detail-news/en/c/1261182/>

Table 3.6 Ranking of gross total sheepmeat exporters inter-regionally (selected MENA countries) (tonnes), 2017-2021

Ranking	Israel	Jordan	Kuwait	Oman	UAE
1st	-	Saudi Arabia	UAE	UAE	Saudi Arabia
2nd	-	Lebanon	Saudi Arabia	Qatar	Oman
3rd	-	-	Lebanon	Saudi Arabia	Jordan
4th	-	-	Oman	Kuwait	Iran
5th	-	-	Jordan	Jordan	Lebanon

Note: FAO data includes estimates and unofficial figures

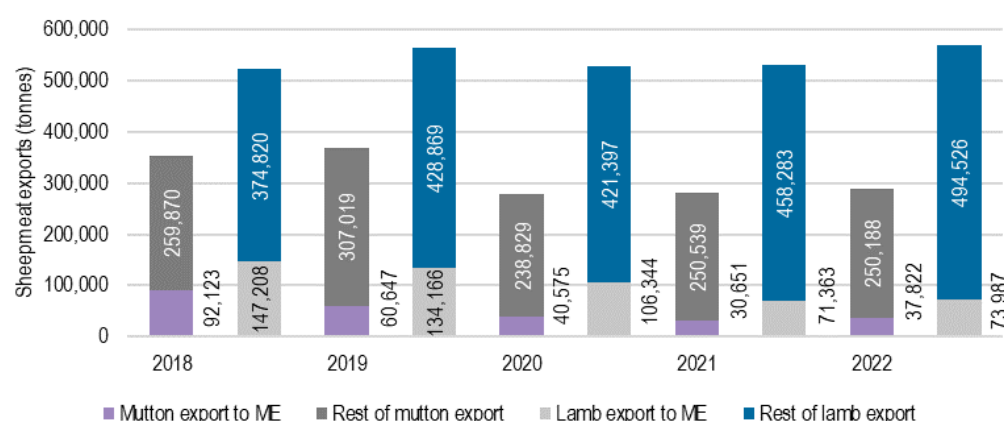
Source: ACIL Allen based on United Nation's Food and Agriculture Organization, 2021

3.3.6 Australian sheepmeat exports to all MENA countries

Although many consumers in the MENA region prefer live sheep that can be slaughtered and butchered locally, the preference for sheep protein also drives substantial demand for both chilled and frozen sheepmeat.

In 2022, Australia exported 288,009 tonnes of mutton and 568,513 tonnes of lamb, with 13% of each (37,822 tonnes of mutton and 73,987 tonnes of lamb) going to all MENA countries. While mutton has experienced some decline since 2019, lamb exports have remained consistent in the last five years with some fluctuations primarily due to COVID-19 disruptions.

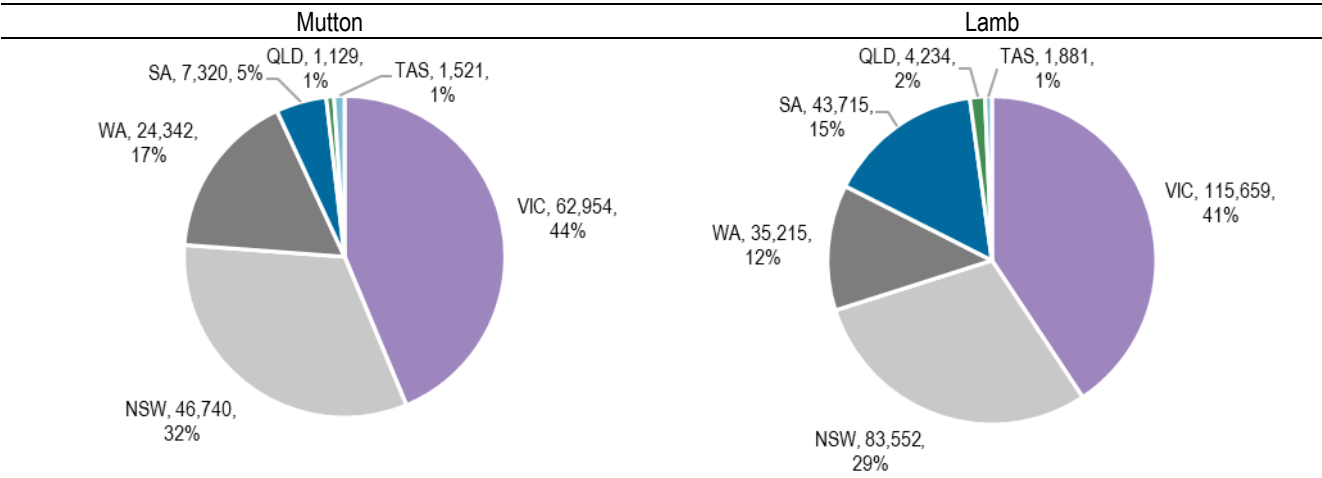
Figure 3.23 Chilled and frozen sheepmeat exports from Australia to all MENA countries by calendar year (2018-2022)



Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, February 2023

Unlike live sheep, sheepmeat is exported from all Australian states. In 2022, Victoria accounted for about 40% of the global market, followed by New South Wales (30%). Western Australia exported 24,352 tonnes (17%) of mutton and 35,215 tonnes (12%) of lamb as seen in Figure 3.24.

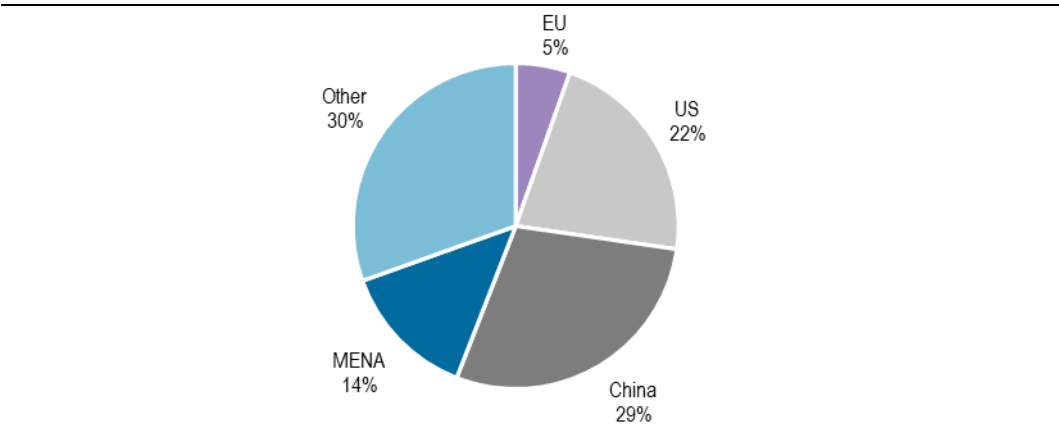
Figure 3.24 All Australian sheepmeat exports by state of origin, 2022



Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, February 2023

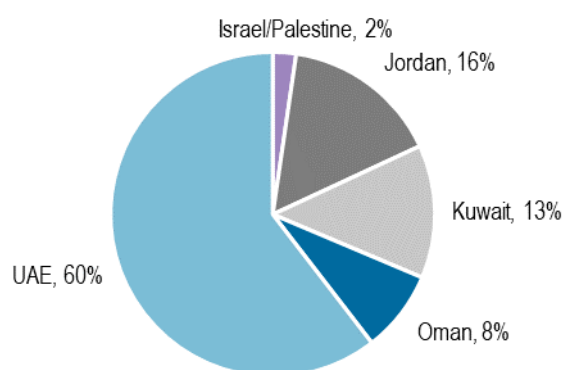
In 2022, Australia exported 430,000 tonnes of sheepmeat. Australia’s major markets are China, the US and MENA countries (see Figure 3.25).

Figure 3.25 Share of sheepmeat exports from Australia to key markets, 2022



Note: All MENA countries
Source: ACIL Allen based on Department of Agriculture, Fisheries and Forestry, 2023

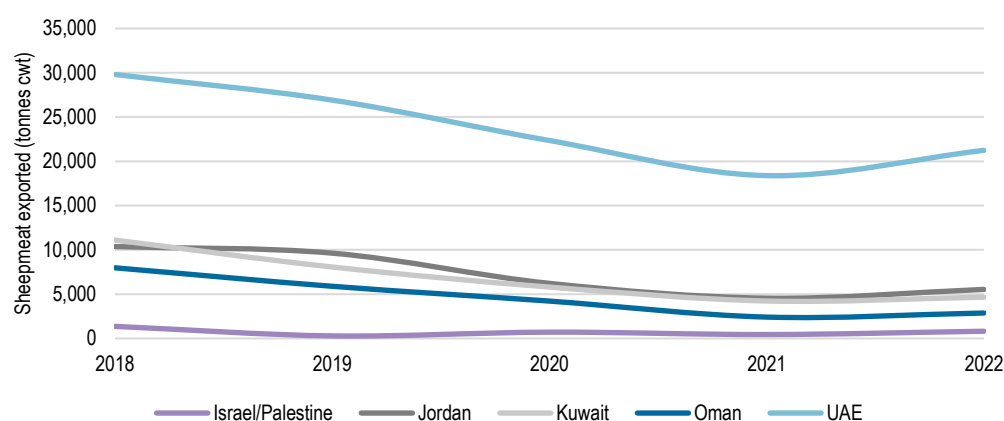
The export of sheepmeat from Australia to the UAE is significantly higher than other countries in this analysis, at 60% (over 21,000 tonnes carcass weight (cwt) in 2022). The country with the second highest import of Australia’s sheepmeat is Jordan (16%, 5,500 tonnes cwt), followed by Kuwait (13%, 4,700 tonnes cwt), Oman (8%, 2,900 tonnes cwt), and Israel (800 tonnes cwt). Figure 3.26 shows the share of Australia’s sheepmeat exports to the five countries of focus.

Figure 3.26 Relative share of Australia's sheepmeat export to selected MENA countries, 2022

Source: ACIL Allen based on Meat & Livestock Australia, 2023

From 2018 to 2021, the export of Australian sheepmeat to these countries has been decreasing. Among these countries, the UAE observed the most significant decrease, down 38% during this period. A factor contributing to this decline is the high cost per head of sheep in Australia, as illustrated in Figure 2.10 and Figure 2.11.

Other commonly cited reasons for this decline are decreasing oil prices reducing incomes in these countries, and the COVID-19 pandemic which significantly increased freight costs.⁵⁷ However, in 2022, there was a small recovery in the quantity of sheepmeat exports to all focus countries as economic conditions improved. Refer Figure 3.27.

Figure 3.27 Australia's sheepmeat export to selected MENA countries by calendar year (2018-2022)

Source: ACIL Allen based on Meat & Livestock Australia, 2023

⁵⁷ Meat & Livestock Australia 2021, *MENA Beef and Sheepmeat Snapshot*, accessed 6 April 2023

Conclusion

4

4.1 Key findings

4.1.1 Value and importance to the economy

National contribution

In the last five years, the live sheep export industry (live sheep and the associated wool clip) has, on average, directly contributed \$52 million of value-added annually and directly employed 168 FTEs. This is 1.4% of the national sheep industry value.

Western Australian contribution

As Western Australia dominates live sheep exports, the results are very similar to the national contribution but live sheep exports (sheep plus the associated wool clip) account for a higher proportion (6.1%) of the total sheep industry value-added in Western Australia.

In the last five years, the live sheep export industry in Western Australia (live sheep and the associated wool clip) has, on average, directly contributed \$45 million of value-added annually and on average directly employed 152 FTEs.

Total (indirect plus direct) contribution for the live sheep export industry had an upper bound of \$71 million value-added annually, distributed across other industries in the Western Australian economy. Outside the agriculture sector the largest impacts are seen in health care and social assistance, accommodation and food services, manufacturing and education and training.

4.1.2 Impact of cessation of sheep live export

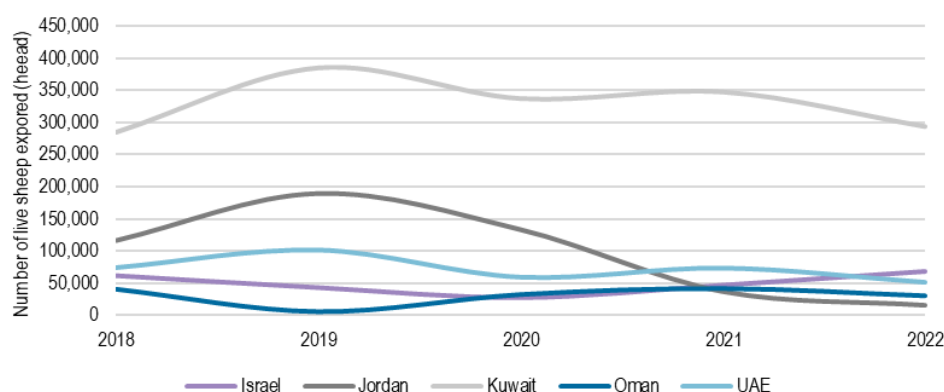
Without the option of live sheep exports there is an estimated a 19.19% reduction in the per head value of a wether in Western Australia, or in dollar terms a decline of \$21.84 per wether (with a price response).

4.1.3 Markets and trade

Australia has a large and sustained presence in both the live sheep market and the sheepmeat market in the Middle East.

In recent years five countries (Israel, Jordan, Kuwait, Oman, and the UAE) have imported more than 80% of Australia's live sheep exports with a value of \$92 million in 2021. Over the last five years Kuwait has consistently imported large numbers of Australian live sheep even during the COVID-19 pandemic. Refer Figure 4.1.

Figure 4.1 Australia's live sheep exports to selected MENA countries (calendar year, 2018-2022)



Source: ACIL Allen based on Meat & Livestock Australia, 2023

Live Australian sheep are preferred for quality, consistency and quality and the long-standing relationships and partnerships that have been established between Australian live sheep exporters and buyers in the region. For example, Australia has been supplying Kuwait with live sheep for over 60 years.⁵⁸ Many of these long-term relationships are built on trust, reliability, and a shared commitment to quality and customer satisfaction. Australia also has similar trade relationships, and strengths, in the sheepmeat markets in MENA, with market share of 55%. While the amount of Australian sheepmeat into the five countries of focus has declined in recent years, volumes are expected to grow over the next few years.

Although boxed or chilled meat may be a convenient and practical alternative to live sheep in some circumstances, it cannot fully replicate the cultural, religious, traditional and practical importance of live sheep in the Middle East⁵⁹, particularly during religious festivals such as Eid al-Adha.

Based on available data (which is limited), it is concluded that these countries will raise their live sheep imports from other nations rather than substantially increase their imports of Australian boxed or chilled sheepmeat. The key importers into the region include European nations such as Portugal, Spain, and Romania as well as Somalia, the Sudan and India. Inter-regional trade is dominated by Jordan, Saudi Arabia, Iran, and the UAE.

⁵⁸ Refer: <https://www.afr.com/companies/agriculture/kuwait-says-live-sheep-trade-vital-as-producers-turn-on-albanese-20230317-p5ct3y> accessed 22 April 2023.

⁵⁹ Nath et al. (2012). Impact on Western Australia's sheep supply chain of the termination of live sheep exports, Contributed paper for the 56th AARES annual conference, Fremantle, Western Australia, February 7-10, 2012.

Limitations and future research

5

5.1 Limitations

This project was limited by the following:

- Availability of public information, particularly in quantitative data from the countries of focus.
- Use of a real options model previously developed in 2017 (using updated data but with no change to the assumptions).

5.2 Future research

This project was constrained by the limited availability of public information, particularly quantitative data from the specific countries of focused. Therefore, future research endeavours should prioritise the quantification of the potential impact if Australia were to cease its live sheep export trade in the Middle East. Additionally, expanding the analysis to encompass all importers of Australian live sheep would provide a more comprehensive understanding of the trade dynamics.

Potential areas of focus for future research could include:

- Quantifying the trade implications of discontinuing live sheep exports from Australia.
- Conducting a thorough trade analysis encompassing all countries that import live sheep from Australia.
- Updating the assumptions of the real options model to incorporate market dynamics and climate-related factors such as drought conditions.
- Collecting primary data to better inform the real options model.

By addressing these research gaps, future studies can contribute to a more comprehensive and nuanced understanding of the implications, challenges, and opportunities associated with potential changes in Australia's live sheep export trade in the Middle East and beyond.

Appendices

Socio-economic profiles - key markets

A

The Middle East and North Africa (MENA) region includes 19 countries and makes up approximately 6% of the world's population. Due to its substantial petroleum and natural gas reserves, MENA is an important source of global economic stability. The MENA region accounts for approximately 45% and 60% of the world's natural gas and crude oil reserves, respectively.

According to Middle East and North Africa Economic Update⁶⁰ report by the World Bank in October 2022, the MENA region's economy will grow by 3.5% in 2023, which is the fastest rate since 2016. However, this growth is uneven as many countries struggle to overcome the lasting effects of the COVID-19 pandemic.

The MENA region has a mixture of both very wealthy and less wealthy countries. In 2022, there were approximately 6.9 million households who earn more than \$35,000 (US\$), and approximately 3.9 million households who earn more than \$50,000 (US\$).⁶¹

The region is highly populated (486.2 million people)⁶² with a young population (median age of 26.8 years old)⁶³ and a higher-than-average population growth at 1.3%, far exceeding the global average of 0.9%.⁶⁴ The region is also very culturally diverse.

A.1 Israel

Israel has a robust and stable economy. Its GDP per capita is approximately \$52,000 and economic growth is expected to accelerate in 2024, as inflation abates. Israel has a high employment rate (only 3.9% of the total labour force in Israel is unemployed (2022)).⁶⁵ A large part of the economy is funded by natural resources, specifically its mineral resources and power industries. Israel's economy is also heavily supported by immigrants and foreign workers.

⁶⁰ The World Bank. *Middle East and North Africa Economic Update*.

<https://www.worldbank.org/en/region/mena/publication/middle-east-and-north-africa-economic-update>

⁶¹ Meat & Livestock Australia, *Market Snapshot | Sheepmeat – MENA (Middle East & North Africa)*,

Accessed 28 March 2023, <https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/export-statistics/oct-2018-snapshots/mla-sheepmeat-market-sn89apshot---mena---oct-2018-v2.pdf>

⁶² World Bank 2021, *Population growth (annual %)*, accessed 29 March 2023,

<https://data.worldbank.org/indicator/>

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ Central Bureau of Statistics Israel, *Unemployment*, accessed 4 April 2023,

<https://www.cbs.gov.il/en/Pages/default.aspx>

The country is small and is densely populated. Israel has a diverse culture, history, and population. Israel's population is approximately 9.7 million (2023)⁶⁶, with a population growth rate of 1.6% (2021).⁶⁷ The life expectancy at birth is 83 years old.⁶⁸ The population is also growing, with high birth and a relatively young population (approximately one-fourth are 15 years or younger)⁶⁹. Many people immigrate to or work in Israel, and its migrant and foreign worker population is set to grow as Israel continues to industrialise.

Israel's limited geographical size and growing population creates high demand for food imports.

A.2 Jordan

The economy of Jordan is developing. The GDP per capita was approximately \$4,103 (US\$)⁷⁰ in 2021 and 18.4% of the labour force was unemployed⁷¹. However, Jordan has a positive GDP growth rate of 2.2% annually⁷², suggesting that the economy is slowly gaining strength. Jordan is also using its strength in tourism to boost its economy, specifically after the effects of COVID-19. With robust and sustainable economic policy, Jordan has the potential for growth.

Jordan has a population of 11.1 million as of 2021⁷³ with an annual population growth of 2%⁷⁴. Its small population is an attribute of Jordan being a relatively young country, as it was only an independent kingdom from 1946 onwards.⁷⁵ However, the birth rate is high and the growth rate is almost double the world's average, further supporting growing Jordanian infrastructure, business, and society. The population of Jordan is also predominantly young, with around one-third under the age of 15. Jordan has had a lot of internal migration from rural areas to bigger cities.

Despite its population size and economy, Jordan consumes a high percentage of sheepmeat. In 2021, Jordan was the fourth largest importer of sheep and goats in the world (\$175 million)⁷⁶. Domestically, sheep and goat are amongst the top 20 products imported by Jordan.⁷⁷

⁶⁶ Central Bureau of Statistics Israel, *Population*, accessed 4 April 2023, <https://www.cbs.gov.il/en/Pages/default.aspx>

⁶⁷ World Bank, *Population growth (annual %) – Israel*, accessed 28 March 2023, <https://data.worldbank.org/country/israel>

⁶⁸ World Bank, *Life expectancy at birth, total (years) – Israel*, accessed 28 March 2023, <https://data.worldbank.org/country/israel>

⁶⁹ Encyclopedia Britannica, *Demographic Trends – Israel*, accessed 31 March 2023, <https://www.britannica.com/place/Israel/Demographic-trends>

⁷⁰ World Bank, *GDP per capita (current US\$) – Jordan*, accessed 5 April 2023, <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=JO>

⁷¹ World Bank, *Unemployment, total (% of total labor force) (modeled ILO estimate) – Jordan*, accessed 5 April 2023, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JO>

⁷² World Bank, *GDP per capita (current US\$) – Jordan*, accessed 5 April 2023, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JO>

⁷³ World Bank, *Population, total – Jordan*, accessed 5 April 2023, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=JO>

⁷⁴ World Bank, *Population growth (annual %) – Jordan*, accessed 5 April 2023, <https://data.worldbank.org/indicator/SP.POP.GROW?locations=JO>

⁷⁵ Encyclopedia Britannica, *Jordan*, accessed 5 April 2023, <https://www.britannica.com/place/Jordan>

⁷⁶ The Observatory of Economic Complexity, *Sheep and Goats in Jordan*, accessed 5 April 2023, <https://oec.world/en/profile/bilateral-product/sheep-and-goats/reporter/jor>

⁷⁷ Meat & Livestock Australia, *MARKET SNAPSHOT | BEEF & SHEEPMEAT*, accessed 5 April 2023, https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/export-statistics/november-2021/2021-mena-market-snapshot-red-meat_111121_distribution.pdf

A.3 Kuwait

Kuwait is regarded as a 'wealthy' country by virtue of its expansive petroleum extraction and processing industry; however, most people work in services and industry.

Kuwait has approximately 102 billion barrels worth of crude oil reserves, which further makes up around 7% of the entire world's reserves.⁷⁸ Unemployment is low at 2.8% (2021)⁷⁹ and Kuwait is heavily reliant on foreign labour. Its GDP per capita was approximately \$24,300 (US\$)⁸⁰; however, this is down on pre-COVID times as there was a substantial reduction in foreign workers during the pandemic.

Located on the Persian Gulf and one of the major urbanised countries in the world, Kuwait's population is approximately 4.2 million (2022).⁸¹ Kuwait is home to a diverse range of cultural groups, with several historically important class divisions. However, Kuwaitis are a minority in their own country.

Migrant workers comprise about two-thirds of the population, some from other Arab states, but mostly from South and Southeast Asia.⁸² Although the population is not growing rapidly the birth rate is close to the world average,⁸³ and it is relatively young (approximately 25% are 15 years or younger).⁸⁴

A growing economy and high per capita income drive the consumption of sheep, which Kuwait is unable to produce domestically at scale, and is therefore highly dependent on imports.

A.4 Oman

Oman has a diverse economy. Its GDP per capita was \$19,509 (US\$) in 2021⁸⁵ and it has an annual growth rate of 4.1% (2023).⁸⁶ Though Oman has a thriving agricultural sector, it is mainly focused on fishing and exports, which is why it imports large amounts of live sheep and sheepmeat. The Oman economy is also thriving due to its commercial oil productions. Oil represents of two-fifths of Oman's GDP, and a significant part of the government income.⁸⁷ Only 2.5% of the labour force is unemployed.⁸⁸

⁷⁸ Encyclopedia Britannica, *Economy of Kuwait*, accessed 3 April 2023, <https://www.britannica.com/place/Kuwait/Demographic-trends#ref45147>

⁷⁹ World Bank, *Unemployment, total (% of total labor force) (modeled ILO estimate) - Kuwait*, accessed 28 March 2023, <https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=KW>

⁸⁰ World Bank, *GDP per capita (current US\$) - Kuwait*, accessed 28 March 2023, <https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=KW>

⁸¹ Kuwait Central Statistical Bureau, *Population and Households of Kuwait*, accessed 4 April 2023, <https://knoema.com/KWPH2013/population-and-households-of-kuwait>

⁸² World Bank, *Population, Total - Kuwait*, accessed 28 March 2023, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KW>

⁸³ World Bank, *Life expectancy at birth, total (years) - Kuwait*, accessed 28 March 2023, <https://data.worldbank.org/indicator/SP.POP.TOTL?locations=KW>

⁸⁴ Encyclopedia Britannica, *Demographic Trends - Kuwait*, accessed 31 March 2023, <https://www.britannica.com/place/Kuwait/Demographic-trends>

⁸⁵ The World Bank, *GDP (current US\$) - Oman*, accessed 3 April 2023, <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=OM>

⁸⁶ International Monetary Fund, *Oman*, accessed 3 April 2023, <https://www.imf.org/en/Countries/OMN>

⁸⁷ Encyclopedia Britannica, *Economy of Oman*, accessed 3 April 2023, <https://www.britannica.com/place/Oman/Economy>

⁸⁸ Foreign Ministry of Oman, *Economy*, accessed 3 April 2023, <https://fm.gov.om/about-oman/state/economy/>

A Gulf State, on the Arabian Peninsula, Oman serves as a major trading country. Oman's population is approximately 5 million (2023).⁸⁹ In recent years there has been an increasing number of immigrants from around the world. The population, like many Gulf countries is young, with approximately half the population under 30 years old.⁹⁰

Oman's sheepmeat consumption is among the highest in the world at 12.2kg per capita annually.⁹¹ The country imports large amounts of both live sheep and meat to meet domestic demand.

A.5 United Arab Emirates

The UAE has one of the most open economies in the world, existing as a hub of global business and trade. The UAE's GDP per capita was approximately \$44,315 (US\$) in 2021⁹² with the economy expanding at 7.6% (2022).⁹³ UAE has 10% of the world supply of oil reserves, and the world's fifth largest natural gas reserves. The UAE has become a place for major business and commercial organisations. The unemployment rate is 3.1% but this number does not account for the number of expatriates and non-citizens who work in the UAE. Other than oil, the agricultural production and fishing industries of the UAE are expanding, although they contribute very little to the GDP.

The UAE is a prosperous country known for its oil industry, technological development, and financial opportunities. The UAE's population is approximately 9.3 million (2021)⁹⁴ but only around 10% of the residents of the UAE are citizens. The remainder of the population are foreign workers and their families.⁹⁵ The UAE population is concentrated in coastal cities due to the trading and business opportunities that exist there. Around 75% of the population are younger than 45 years old.⁹⁶

The young, growing population of UAE provides a great substantial market for the consumption and import of sheep. The UAE's sheepmeat consumption per capita was 11.8kg (2021), one of the highest in the world.⁹⁷

⁸⁹ National Centre for Statistics & Information, *Population*, accessed 4 April 2023, <https://data.gov.om/OMPOP2016/population>

⁹⁰ Encyclopedia Britannica, *Demographic Trends – Oman*, accessed 31 March 2023, <https://www.britannica.com/place/Oman/Plant-and-animal-life#ref257073>

⁹¹ Meat & Livestock Australia, *Market Snapshot | Beef & Sheepmeat*, accessed 31 March 2023, https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/export-statistics/november-2021/2021-mena-market-snapshot-red-meat_111121_distribution.pdf

⁹² World Bank, *GDP (current US\$) – United Arab Emirates*, accessed 3 April 2023, <https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=AE>

⁹³ Uppal, R., *UAE's GDP grew 7.6% in 2022, econ minister says*, accessed 3 April 2023, <https://www.reuters.com/world/middle-east/uae-gross-domestic-product-grew-76-2022-minister-2023-03-02/>

⁹⁴ World Bank, *Population, total – United Arab Emirates*, accessed 4 April 2023, <https://data.worldbank.org/country/united-arab-emirates>

⁹⁵ Encyclopedia Britannica, *People of the United Arab Emirates*, accessed 28 March 2023, <https://www.britannica.com/place/United-Arab-Emirates/Land#ref45238>

⁹⁶ Encyclopedia Britannica, *Demographic trends of the United Arab Emirates*, accessed 28 March 2023, <https://www.britannica.com/place/United-Arab-Emirates/Land#ref45238>

⁹⁷ Meat & Livestock Australia, *Market Snapshot | Beef & Sheepmeat*, accessed 31 March 2023, https://www.mla.com.au/globalassets/mla-corporate/prices--markets/documents/os-markets/export-statistics/november-2021/2021-mena-market-snapshot-red-meat_111121_distribution.pdf

Input-Output analysis

B

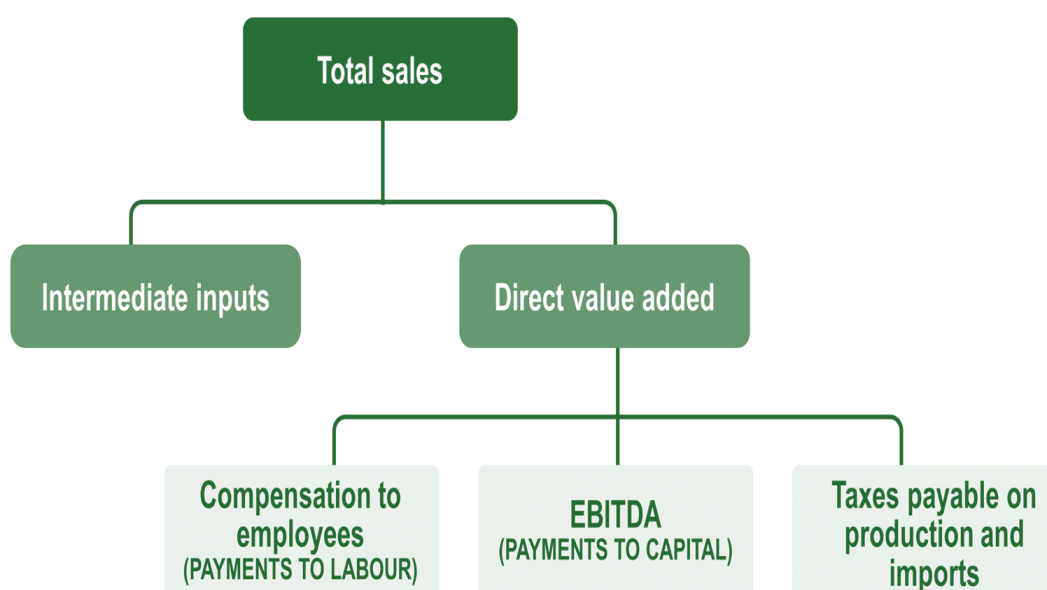
B.1 Direct economic contribution

The standard measure of economic contribution is the extent to which it increases the value of goods and services generated by the economy as a whole – in other words, the extent to which it increases economic activity as measured by gross domestic product (GDP). An economy has a range of factors of production (including labour and capital stock) and access to various intermediate inputs. By using the factors of production appropriately industries add value to intermediate inputs by converting them into a range of goods and services more suited for use by consumers or other industries. An industry or business' contribution to GDP measures the total value added generated and is defined as the income that an industry or business generates, less the cost of the inputs that it uses to generate that income, plus certain taxes paid.

The direct contribution of an industry or a company to the Australian economy can therefore be estimated by determining their payments to the factors of production plus the taxes (less subsidies) payable on production and imports. This is shown graphically in **Figure B.1**.

The box overleaf provides a summary of the definitions used by the ABS as part of the System of National Accounts 1993 (SNA93).

Figure B.1 EBITDA is equivalent to the SNA93 definition of gross operating surplus



Source: ACIL Allen

Box 5.1 ABS definitions of value add

An industry's direct contribution to Gross Domestic Product or Gross State Product is well defined under the standard national accounting framework used by the Australian Bureau of Statistics (ABS), which is known as the System of National Accounts 1993 (SNA93). SNA93 recognises three different measures of value added:

- Value added at Purchasers' Prices. This is defined as output valued at purchasers' prices, less intermediate consumption valued at producer prices. This measure is equivalent to the traditional measure of value added at market prices.
- Value added at Basic Prices. In this measure, the output is valued at basic prices while intermediate consumption is valued at producer prices. In the case of beer production this measure excludes beer excise as they are viewed as production taxes levied on output.
- Value added at factor Cost. This measure excludes all production taxes net of subsidies. In other words, it excludes all production taxes – such as payroll taxes, fringe benefit taxes etc – and not just those that are levied on output.

The measure of value added to be used depends on the nature of the analysis that is to be conducted. When presenting an industry view of GDP for example, the ABS uses value added at basic prices and adds an aggregate estimate of net taxes on products in question to give a total measure of GDP at purchasers' prices (ABS 1999).

B.2 Indirect economic contribution

Indirect effects are a broader notion of the economic contribution that includes supply-side effects of agriculture expenditure beyond the direct component. For example, when a producer buys fertiliser, indirect effects are generated for the businesses supplying the product, the transporter who made deliveries to the supplier, the electricity company and other businesses that provided the inputs required to operate the supplier's business. To fully measure the indirect effects, account should also be taken of changes in incomes which may feed through to further changes in domestic demand.

The intermediate inputs used by an industry (fertilisers used by producers, for example) can be sourced either from within the Australian economy or from foreign economies. If purchased from within the Australian economy, then the portion of value added embodied in the intermediate input is indirectly associated with the activity of the purchaser. The calculation of the indirect contribution quickly becomes difficult as one considers that value-added embodied in the intermediate inputs of the intermediate input. For example, to make the fertilisers used by producers, consider the feedstock used in the fertiliser manufacturing, and the raw materials used in the feedstock, and so on.

Input-output tables and the associated 'input-output multipliers' can be used to estimate the indirect economic contributions. Input-output multipliers are summary measures generated from input-output tables that can be used for predicting the total impact on all industries in the economy of changes in demand for the output of any one industry. The tables and multipliers can also be used to measure the relative importance of the production chain linkages to different parts of the economy.

It should be noted that some of the assumptions underpinning input-output multipliers can be an impediment to credible analysis. Understanding these assumptions is necessary to prevent the inappropriate application of input-output multipliers – for example, in situations where economic constraints are present or when the profile of a business or project differs substantially from the industry average. We do not consider that these conditions apply for the purpose of this analysis and that the use of input-output multipliers to estimate the economic footprint of the live sheep

export industry is appropriate. Further information on input-output tables and the calculation of multipliers can be found in ABS Catalogue number 5246.0.

Lower and upper bounds

In this report we have estimated the likely lower and upper bounds of the indirect economic contribution of the sheep industry's activities. The lower bound estimate, derived from the 'Simple Multipliers,' captures only the value added and employment associated with the supply chain of each purchase stream (see below for details). Consequently, they provide a conservative estimate – or lower level bound – of the indirect economic contribution of intermediate inputs. The difference between these estimates and the direct economic contribution are commonly referred to as the 'production induced' contribution. The estimate from simple multipliers indicates the embodied economic contribution of various production chains.

The upper bound estimate of the impact of the sheep industry, derived using 'Total Multipliers,' captures the effects of inter-industry interactions and captures the impacts of the purchasing decisions made by workers employed throughout the industry's supply chain. This effect is commonly referred to as the 'consumption induced effect.'

B.3 Overview of Input-Output tables

Input-output tables provide a snapshot of an economy at a particular time. The tables used in this analysis were for the 2020-21 financial year to coincide with the year of the analysis.

Input-output tables can be used to derive input-output multipliers. These multipliers show how changes to a given part of an economy impact on the economy as a whole. A full set of input-output multipliers for each region were estimated for the purpose of this analysis.

The input-output multipliers allow rigorous and credible analysis of the economic footprint of a particular facility, industry, or event for the region of interest. Although input-output multipliers may also be suitable tools for analysing the impact of various types of economic change, caution needs to be adopted in their application for this purpose. Misuse of input-output multipliers for the purpose of impact analysis has led to scepticism of their general use in favour of other tools such as computable general equilibrium (CGE) modelling. Notwithstanding this, they are still eminently suitable for understanding the economic linkages between a given facility or industry to gain an appreciation of the wider interactions of the industry beyond its direct contribution.

B.4 Multiplier types

Input-output multipliers estimate the economic impact on a region's economy from a one dollar change in the final demand for the output of one of the region's industries. Generally, four types of multipliers are used:

- Output – measures the impact on the output of all industries in the economy
- Income – measures the effect on the wages and salaries paid to workers within the economy
- Employment – measures the jobs creation impact, and
- Value-added – measures the impact on wages and salaries, profits, and indirect taxes.

The sum of wages and salaries, profits and indirect taxes for a given industry provides a measure of its contribution to the size of the local economy – its contribution to gross regional product (GRP). The value added multiplier can therefore also be considered to be the GRP multiplier (or GSP multiplier or GDP multiplier).

Input-output multipliers are a flexible tool for economic analysis. Their flexibility stems from the different forms of each multiplier type. For each region, multipliers were estimated in the following forms:

- initial effects
- first round effects
- industrial support effects
- production induced effects
- consumption induced effects
- simple multipliers
- total multipliers
- type 1A multipliers
- type 1B multipliers
- type 2A multipliers
- type 2B multipliers.

B.4.1 Multiplier effects

When additional sales to final demand are made, for example through increased exports or sales to the public, production increases to meet the increased demand, and this is the initial effect. Since production increases to exactly match the increased final demand, the increase is always equal to one (noting that the multipliers are defined in terms of a one dollar increase in final demand).

The industry producing the additional output makes purchases to enable itself to increase production, these new purchases are met by production increases in other industries, and these constitute the first round effect. These first round production increases cause other industries to also increase their purchases, and these purchases cause other industries to increase their production, and so on. These 'flow-on' effects eventually diminish, but when added together constitute the industrial support effect.

The industrial support effect added to the first round effect is known as the production induced effect. So far this chain of events has ignored one important factor, the effect on labour and its consumption. When output increases, employment increases, and increased employment translates to increased earnings and consumption by workers, and this translates to increased output to meet the increased consumption. This is the consumption effect.

B.4.2 Multipliers

The simple and total multipliers are derived by summing the effects. The simple multiplier is the sum of the initial and production induced effects. The total multiplier is larger because it also adds in the consumption effect. So far, all the effects and multipliers listed have had one thing in common, they all measure the impact on the economy of the initial increase in final demand.

The remaining multipliers take a different point of view, they are ratios of the above multiplier types to the initial effect. The type 1A multiplier is calculated as the ratio of the initial and first round effects to the initial effect, while the type 1B multiplier is the ratio of the simple multiplier to the initial effect. The type 2A multiplier is the ratio of the total multiplier to the initial effect, while the type 2B multiplier is the ratio of the total multiplier less the initial effect to the initial effect.

Given the large number of multiplier types to choose from, output, income, employment and value added multipliers, and each with numerous variations (simple, total, type 2A, etc.) it is important that the analysis uses the most appropriate multipliers. Usually, the multipliers that include consumption effects (i.e., the added impact that comes from wage and salaries earners spending

their income) are used. These are the total and type 2A multipliers. The total and type 2A multipliers will generally provide the biggest projected impact. Simple or type 1B (which omit the consumption effect) may be used to provide a more conservative result.

B.5 Limitations of Input-Output analysis

Although input-output analysis is valid for understanding the contribution a sector makes to the economy, when used for analysing the potential impacts of a change in production of a particular sector, input-output analysis is not without its limitations. Input-output tables are a snapshot of an economy in a given period, the multipliers derived from these tables are therefore based on the structure of the economy at that time, a structure that it is assumed remains fixed over time. When multipliers are applied, the following is assumed:

- prices remain constant
- technology is fixed in all industries
- import shares are fixed.

Therefore, the changes predicted by input-output multipliers proceed along a path consistent with the structure of the economy described by the input-output table. This precludes economies of scale. That is, no efficiency is gained by industries getting larger – rather they continue to consume resources (including labour and capital) at the rate described by the input-output table. Thus, if output doubles, the use of all inputs doubles as well.

One other assumption underpinning input-output analysis which is worth considering is that there are assumed to be unlimited supplies of all resources, including labour and capital. With input-output analysis, resource constraints are not a factor. It is thus assumed that no matter how large a development, all required resources are available, and that there is no competition between industries for these resources.

It is important to understand the limitations of input-output analysis, and to remember that the analysis provides an estimate of economic contribution of a facility or industry, not a measurement of economic impact if the facility or industry shut down or did not exist.

Price elasticities

C

In the real options modelling ACIL Allen makes use of own-price elasticities to estimate the price impacts of supply changes. Own price elasticity is defined as the percentage change in quantity demanded divided by the percentage change in price. For most commodities these elasticities are negative numbers, indicating that the change in quantity demanded and the change in price are of opposite signs. This makes sense, as it indicates that as price rises the quantity demanded falls. Equally, it indicates that an increase in supply will lead to a price decline.

To estimate reasonable values for elasticities for this analysis, three references have been considered; Griffith et al. (2001),⁹⁸ Mounter et al. (2012)⁹⁹ and Fisher (1979)¹⁰⁰. In these publications the elasticity estimates for domestic lamb and mutton sales are regularly in the range of -1 to -2. Assuming an elasticity of -1.5 seems a reasonable starting point for the analysis. While the export elasticity for lamb and mutton is lacking in these publications, values for beef exports in Griffith et al. (2001) suggest an elasticity estimate of -2.5 is a reasonable starting point.

The modelling done in this report does not differentiate between domestic and export markets when it comes to estimating price effects. The analysis begins with the working assumption of an own-price elasticity of -2 for lamb and mutton products produced in Australia and modifies this assumption to accommodate the model presented here which has a purely Western Australia focus. Western Australia represents around 13% of Australian sheepmeat supply (2022).¹⁰¹

As a first step to modifying the assumed Australian own-price elasticity of supply for use with our Western Australia centric model, the elasticity of -2 is divided by 12.4 per cent to give a revised estimate of -16. With this larger elasticity estimate, the price of lamb and mutton products are less sensitive to the percentage change in Western Australia sheep and lamb products than they would be if using total Australia production as the base for the percentage change in supply calculation.

To account for the partial nature of the real options modelling, none of the scenarios contain a representation of the entire sheep production system, the elasticities in use have been increased further. Currently in the modelling the values used for representation of the current system with or without live export range from -25 to -75. To indicate less price responsiveness in the planned phase out case, each of these elasticities have been doubled and range from -50 to -150.

⁹⁸ Griffith, G., l'Anson, K., Hill, D., Lubett, R., & Vere, D. (2001). Previous Demand Elasticity Estimates for Australian Meat Products. NSW Agriculture.

⁹⁹ Mounter, S., Villano, R., & Griffith, G. (2012). Updating a Model of Meat Demand in Australia to Test for the Impact of MSA. Meat & Livestock Australia

¹⁰⁰ Fisher, B. (1979). The Demand for Meat - An Example of an Incomplete Commodity Demand System. Australian Journal of Agricultural Economics, Vol 23, No. 3.

¹⁰¹ In 2018, Western Australia represented a 12% share of the sheepmeat supply.

It is worth considering the sensitivity of the modelling outcomes to the elasticities chosen. To do this consider the sudden cessation of live sheep exports under four separate elasticity assumptions.

These four assumptions are:

1. Infinite own-price elasticity – under which prices do not respond to changes in supply. The no-price adjustment scenario produces an NPV of \$107.58. Refer Figure 3.11.
2. The standard elasticities used for the analysis described and represented modelling in Figure 3.12, producing an NPV of \$91.97.
3. Half the standard elasticities described above, thereby making prices more responsive to the cessation of live sheep exports (not shown in the main body of the report) and producing an NPV of \$76.37.
4. Double the standard elasticities described above, thereby making prices less responsive to the cessation of live sheep exports (not shown in the main body of the report) and producing an NPV of \$99.77.

Considering elasticity assumption 2 as our baseline, we see that halving the elasticity value changes the NPV by -\$15.6 or -17.0%. At the same time, doubling the elasticities changes the NPV by +\$7.80 or +8.5%. This sensitivity analysis demonstrates that the results are sensitive to the chosen elasticity values.

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