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Ensuring a sustainable future for Australia's wool supply chain – Phase 2

WoolProducers Australia

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Glossary

Acronym	Full name
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACWEP	Australian Council of Wool Exporters & Processors
AER	Australian Energy Regulator
ATMAC	Australian Trade and Market Access Cooperative
AWEX	Australian Wool Exchange
AWI	Australian Wool Innovation
AWTA	Australian Wool Testing Authority
DAE-RGEM	Deloitte Access Economics Regional General Equilibrium Model
EOI	Expression of interests
ESP	Early-Stage Processing
FMD	Foot-and-mouth disease
FRED	Federal Reserve Economic Data
IRR	Internal rates of return
MCA	Multi-criteria analysis
NEM	National Electricity Market
NPV	Net Present Value
NSW	New South Wales
NTM	Non-tariff measure
RD&E	Research, Development and Extension
SA	South Australia
the Code	Terrestrial Animal Health Code
VIC	Victoria
WOAH	World Organisation for Animal Health
WPA	WoolProducers Australia

Executive summary

Across 2022 and 2023, WoolProducers Australia (WPA) secured two rounds of funding from the Australian Trade and Market Access Cooperative (ATMAC) program to deliver sequential phases of work aiming to develop pathways for domestic and diversified early-stage wool processing in Australia.

This report forms part of Phase 2 of the ATMAC program funding, and aims to further explore the findings and recommendations from Phase 1, namely to develop a business case that explores potential pathways to develop early-stage processing capacity in Australia.

The business case is developed in line with guidance from Infrastructure Australia reflecting the potential national significance of the project and the emergence of key Commonwealth initiatives such as the National Reconstruction Fund. Consultation with industry stakeholders during Phase 1 identified two critical problems and two opportunities for the wool supply chain. These are summarised in Figure i and include risks of trade disruption from an animal disease outbreak which has the potential to dramatically reduce market access as well as broader trade restriction risks from other countries in the wool supply chain. These problems and opportunities reflect the underlying structure of the Australian wool supply chain, which focusses on exporting raw greasy product with exceptional reliance on a single market.

Figure i Summary of identified problems and opportunities

Source: Deloitte Access Economics

This business case identifies several options for addressing the problems and making the most of the opportunities. The business case progresses an investment response, with alternative options such as the base case (a do-nothing scenario) leaving the supply chain exposed to considerable risk of disruption. **Wet processing** is suggested as the primary option as it best addresses the identified problems and options. Additional dry processing, while complementary, does not support the supply chain's ability to manage animal disease risks, and it comes at a considerable additional capital cost. While not pursued here, the business case would be supported by policy options that focus on strengthening demand in overseas locations.

In developing options to address the problems and opportunities, the focus of this business case has been on commercial viability and efficient delivery models, as well as assessing the need for government support where there is a compelling case for it.

The commercial viability of wool processing in Australia is contingent on a range of key factors that need to be considered in parallel. These include:

- **The need for wet processing** (either alone or with some dry processing) – so animal diseases are inactivated in line with international guidelines
- **servicing worsted markets** – which accounts for the bulk of Australia's wool production
- **having adequate installed capacity** – to maximise operating efficiency

- **a best practice waste treatment system** – which can treat the worst wool scour effluent, to the point where it can be economically discharged with minimal environmental impact
- **locations for processing facilities that:**
  - maximise access to wool via aggregation points – to enable cost effective sourcing and blending of wool
  - can allow for the sourcing of wool through existing transport corridors – so that commodity flows support the minimisation of transport costs.

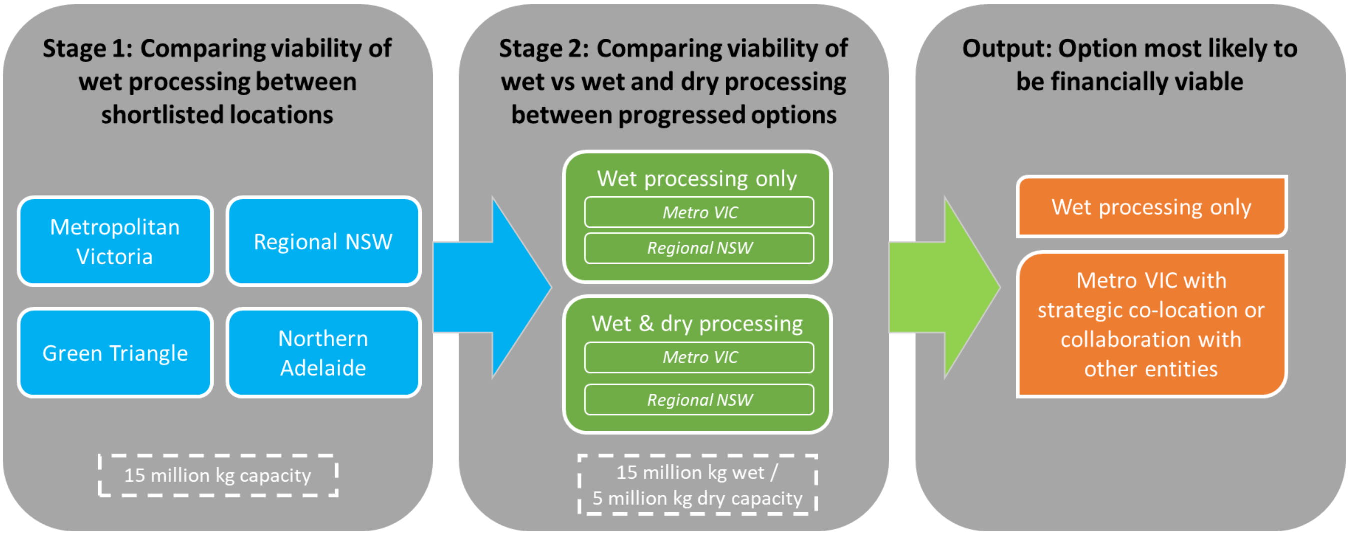
Given the array of potential locations to service, multi-criteria analysis was used to arrive at a shortlist of locations for further analysis. Four regions were ultimately progressed:

- **Metropolitan Victoria,** representing areas such as greater Melbourne and the Barwon region
- **Regional New South Wales (NSW),** including the Riverina and central west NSW
- **Metropolitan Adelaide,** where some early-stage processing already occurs
- **The Green Triangle region,** which borders South Australia and Victoria

Importantly, there is considerable flexibility in how early-stage processing can be undertaken with respect to the key factors outlined above. While the business case details options that would best support addressing the problems and opportunities, other potential solutions are expected to exist outside the shortlisted options.

In line with Infrastructure Australia guidelines, a financial analysis is used to quantify and compare the various options. This involved a two-stage process that modelled two operational early-stage processing systems (wet processing only and wet and dry processing combined) across the four shortlisted locations (Figure ii).

Figure ii: Summary of financial analysis approach and outcomes



Source: Deloitte Access Economics

The financial appraisal results find that a **wet processing only** in **Metropolitan Victoria** as a preferred option for addressing the identified problems and opportunities. Modelling of other considered options found comparable results across several locations, indicating other avenues may also be comparable. In consideration of the level of processing, the analysis found that additional dry processing did not improve the supply chain's ability to mitigate potential animal disease outbreak risks beyond wet processing alone (as no additional scouring is undertaken), but required substantially higher capital investment (Table i).

High capital costs and relatively low returns for wet processing only are assessed to ultimately act as a barrier to investment to wool processing in Australia. Given the national significance of the identified problems and opportunities and the low probability of a purely market led response, these investment barriers could be addressed through Government programs such as the National Reconstruction Fund which aims to advanced Australian manufacturing and support export diversification.

Much of the difference in results across the location is driven by regionally specific energy inputs that influence local utility use costs. This is in part because the analysis utilises recent prices that have been affected by global energy market disruptions. Consideration of energy use across locations is likely to become an increasingly strong factor in the future as the Australian government targets decarbonisation including in manufacturing.

Table i: Summary of financial analysis results, excluding transport, FY24-FY54

Modelling stage	Result	Regional NSW	Metropolitan Victoria	Metropolitan South Australia	Green Triangle
1: Wet processing only	Net Present Value	$0.0	**$12.8**	$3.0	$14.1
	Internal rate of return	0.1%	**0.1%**	0.1%	0.1%
2: Wet and dry processing	Net Present Value	$8.8	$21.8	*Not assessed*	
	Internal rate of return	0.1%	0.1%		

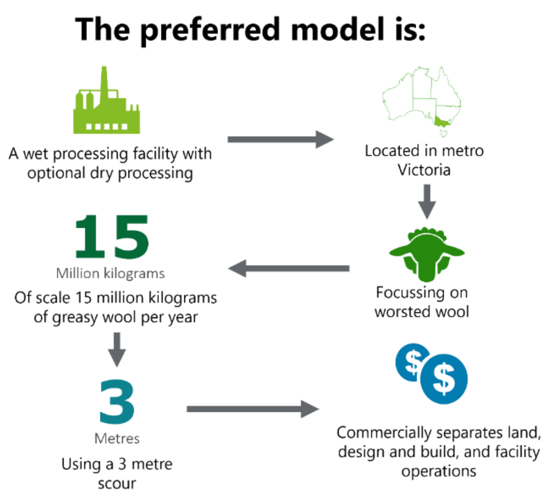
Source: Deloitte Access Economics
Notes: All values are estimated on escalated prices, dollar values are present value terms, discounted at 7%

Through sensitivity testing, the results of the financial analysis also demonstrates that options other than those shortlisted may provide viable pathways to expanding early-stage processing in Australia. These include for example:

- **expansion of existing processors** – to minimise investment required from land acquisitions and construction
- **strategic co-location with complementary industry**– to minimise operational costs such as wastewater treatment or energy inputs.

Importantly, an efficient delivery model is paramount in developing wool processing capacity. This business case examines various delivery models, highlighting potential efficiencies in separating land purchase, facility design and construction, and ongoing facility operation. This strategic approach aims to optimise resource allocation, reduce costs, and enhance overall project outcomes.

Figure iii: Summary of preferred model.



Source: Deloitte Access Economics

This business case provides a comprehensive framework for decision-makers to assess options for addressing the identified problems and opportunities. The business case also showcases the potential for wool processing facilities and outlines a pathway to success with a collaborative effort between the private sector and government. The business case demonstrates an opportunity for wet processing capacity in Australia, provided that strategic factors such as location, processing capabilities, and throughput capacity are carefully considered. Initial Government support, particularly through the National Reconstruction Fund, is likely central for the project's financial viability. For this reason, the business case proposes wet processing only, with complementary dry processing not supporting the supply chain's ability to manage animal disease risks. The proposed separation of land purchase, design and build, and facility operation offers a streamlined delivery model for enhanced efficiency and successful project outcomes.

1 Introduction

WoolProducers Australia (WPA) is the peak national body for the wool producing industry in Australia, representing farmers who have an interest in growing wool. In 2022, WPA secured funding from the Australian Trade and Market Access Cooperative (ATMAC) program to deliver feasibility assessment of domestic and diversified early-stage wool processing and determine its trade risk mitigation benefits.

Deloitte Access Economics was commissioned to deliver the project now known as Phase 1, combining quantitative economic analysis with input from an industry steering committee comprising of representatives from Australian Wool Innovation (AWI), Australian Wool Exchange, Australian Wool Testing Authority, National Council of Wool Selling Brokers and Agents, Australian Council of Wool Exporters and Processors and Austrade.

The feasibility assessment of Phase 1 was conducted in two parts and found that developing early-stage processing capacity in Australia has the potential to be internationally cost-competitive and would provide a meaningful avenue to manage a range of risks in international market.

However, the analysis undertaken by Deloitte Access Economics also found several barriers to expanding early-stage processing capacity in Australia. This includes, for example, that investment attraction was likely challenged by the scale of required outlays and small pool of possible investors, and that the current supply chain expressed little appetite for significant restructure of the supply chain.

Based on the findings of Phase 1, Deloitte Access Economics recommended undertaking further research to consider:

1. pathways to strengthen demand in overseas locations,
2. investment in processing capacity in Australia, and
3. a strategic review of wool investment in Research, Development and Extension (RD&E) to support long term competitiveness.

In April 2023, WPA was announced as the recipient of a second ATMAC grant to further explore the findings and recommendations of the 2022 Phase 1 report, and develop pathways for domestic and diversified early-stage wool processing. In mid-2023, WPA engaged Deloitte Access Economics to undertake a second phase of work (Phase 2). Phase 2 is being delivered in two workstreams aligned with the outcomes of Phase 1.

This business case specifically looks investment in Australian early-stage processing capacity. The structure and content of this business case has been guided by Infrastructure Australia guidelines for the delivery of infrastructure projects. The remainder of this business case is structured as follows:

- **Background** — provides broader context on early-stage processing and Australia's wool industry
- **Case for Change** — outlines the specific problems and opportunities currently faced by the industry
- **Options Development** — details the set of criteria to address the problems and opportunities
- **Value for Money Assessment** — compares the various options through a financial analysis
- **Implementation** — outlines the key procurement, supply, and delivery considerations for the preferred option.

2 Background

Australia's wool primarily delivers a single commodity to a single major market of China. Recent decades have seen offshoring of local wool processing capacity amidst a broader context of consolidating wool production.

2.1 Wool is a significant part of the Australian and global economies

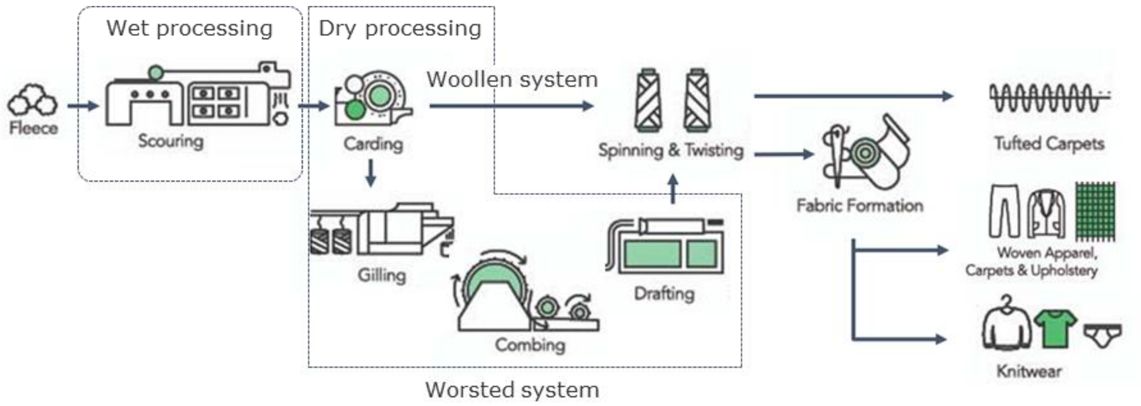
Wool is a textile fibre obtained from mammals and is most typically associated with sheep farming systems. While a relatively small component of the global textile market,[1] it is a significant product for Australia, and Australia is equally important for global wool textile and apparel markets.

In Australia there are around 60,000 woolgrowers, who care for around 68 million sheep. In 2021 Australia produced 228.0 million kilograms of wool, delivering $3.2 billion in income to farmers, and $3.5 billion in export revenue for the Australian economy.[2,3,4]

Once it leaves Australian shores, wool ultimately enters the global apparel and textile market of which Australia accounts for 22.1% of global production. Australia's central role in the wool market is elevated when focusing on fine and super fine production (wool with a fibre diameter of 24.5 um or finer). This segment predominantly supplies high-end textile markets, (such as suits and activewear) and Australia accounts for between 50% to 80% of global production.[5]

These markets are supplied by one of two, individually complex supply chains that combine various processing stages undertaken in various locations around the world. These two supply chains are illustrated in Figure 2.1 and are known as the worsted and woollen systems. Most of Australia's wool is processed through the worsted system, which delivers spun and knitted products for an array of products including business suits. In the woollen system, woollen spun woven fabrics are thicker and heavier and used mostly for outerwear, being bulkier than worsted-spun knitted fabrics.

Figure 2.1: Stylised depiction of worsted and woollen processing systems



Source: Adapted from IWTO (n.d.).[6]

[1] Wool accounts for around 1.2% of the global apparel market by volume, and around 8% by value.
[2] In a relative sense, wool accounted for 3.7% of the total value of Australian farm gate production during this period and 5.3% of the value of exports.
[3] Woolmark, Where Wool Comes From (n.d.) <https://www.woolmark.com/fibre/woolgrowers/where-wool-comes-from/>
[4] ABARES, Agricultural Commodity Statistics (2023) <https://www.agriculture.gov.au/abares/research-topics/agricultural-outlook/data>
[5] IWTO, Market Information Ed. 18 (2023)
[6] IWTO, Woollen Worsted Processing (n.d.) <https://iwto.org/wool-supply-chain/woollen-worsted-processing/>

2.2 Transforming raw wool into consumer products

The processing steps that transform raw wool into worsted and woollen products can be broadly categorised into two stages: early and later stage processing.

- Early-Stage Processing (ESP) consists of a wet-washing stage followed by several mechanical stages where greasy wool is prepared for further processing.
- Latter stage processing forms the wool into yarn via spinning and occurs in both woollen and worsted systems.

2.2.1 Early-stage processing – wet processing

The first step in early-stage processing is the wet washing of wool by scouring. In this step, naturally occurring extraneous matter such as wool wax (grease), vegetable matter (seeds, sticks, grass), and dirt (sand, soil) are removed.[7] It is common practice to recover some of the wool wax from the scouring liquors by centrifuging. This can be refined to produce lanolin. Scouring companies are typically vertically integrated or located close to carding and top-making operations. Most scouring plants are currently located in China.

The process of scouring involves the greasy wool being continuously fed through a series of hot water and detergent tanks (bowls) where most of the fibre contaminants are removed by agitation.

The scoured wool is dried by passing it through a continuous drier. Sometimes it is then mechanically agitated both to remove small amounts of residual dirt and to open up its structure. Lastly, the wool is blended and allowed to stand to condition until its moisture content reaches equilibrium.

Scouring only removes a small amount of vegetable matter. If there is a high percentage of vegetable matter on the greasy wool, wool may also be carbonised during the wet processing stage – a common treatment for wool entering the woollen system. Carbonising involves a treatment after scouring in a second series of bowls before it is dried. The scoured wool is immersed in dilute sulphuric acid before being dried. In the dryer the acid is concentrated on the fibres and the vegetable matter is converted to carbon by the concentrated acid. This leaves the vegetable matter dry and brittle that can be crushed into dust by rollers and removed in a modified opener.

2.2.2 Early-stage processing – dry processing

After wet washing early-stage processing is completed by a second, 'dry processing' stage. Depending on the system, the specific activity of dry processing differs. In the worsted system dry processing involves carding, gilling, and combing whereas in the woollen system the process involves carding alone.

The purpose of carding is to open and disentangle the feed with minimal breakage of fibres; to remove impurities such as vegetable matter; to deliver the carded material as a sliver. This is achieved by passing the clean wool over sets of wired cylinders to open, straighten, separate, and then condense the fibres into a uniform aggregate assembly. Once carded, the wool is gilled. Gilling is done to align the fibres to produce a sliver with a more uniform weight per course length and to add processing aids to the fibre. The next stage is combing that removes shorter fibres (noil). The process is discontinuous. A fringe of sliver is held and any short fibre and vegetable matter, not being held, are removed. The last step in early-stage processing is another gilling in which the relatively uneven sliver is gilled to produce an even sliver (top).

In the woollen system the card web is divided into thin sections that are rubbed to form rovings. These go directly to the spinning process.

2.2.3 Later-stage processing

After early-stage processing, wool is formed into yarn by drafting the fibres, inserting twist and winding the yarn onto a package. This process is known as spinning and occurs in both woollen and worsted systems, as well as for all other fibres (natural materials such as cotton) and filaments (silk and synthetic materials) in textile and apparel production. Combining synthetic and natural materials is common in spinning as are the blending of different natural fibres. Worsted and woollen spinning machines are generally different due to the natures of the feed and the spun yarn.

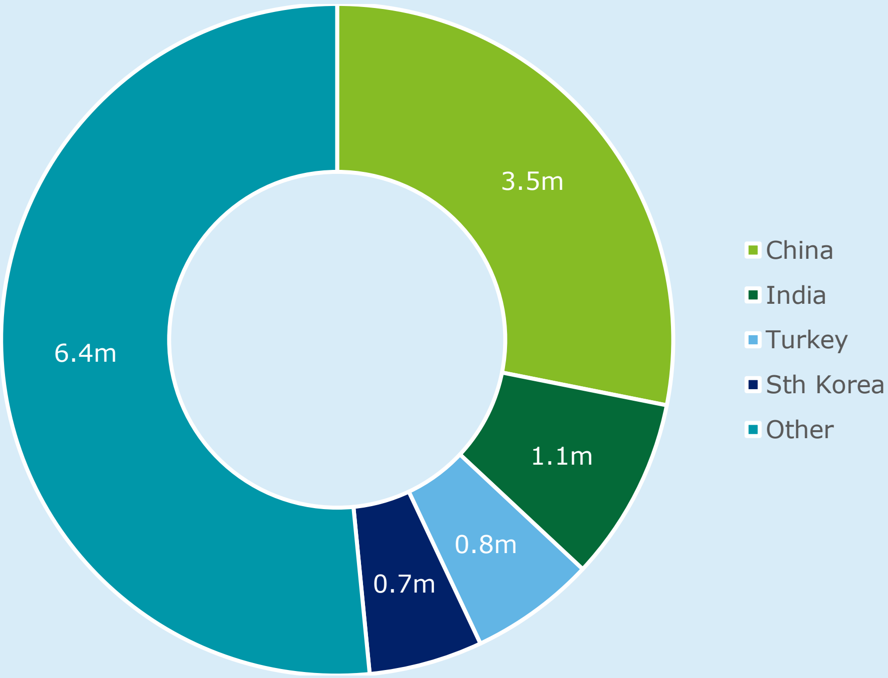
Like early-stage wool processing, wool spinning is also largely concentrated in China. Although global spinning capacity more broadly is geographically more dispersed than early-stage wool processing in part reflecting more diversified production areas.[8] This is illustrated in Chart 2.1 which describes global shares of installed

[7] Each tonne of raw Australian wool contains around 640 kg of wool fibre with the rest consisting of various contaminants including lanolin (approximately 150 kg), suint (the natural wax in the sheep's wool and approximately 40 kg), dirt (150 kg) and vegetable matter (20kg).

[8] The top four cotton producers (India, China, the United States and Brazil) for example comprise approximately 75 percent of global output.

capacity of long-stable spindles for selected countries.[6] At 2021, China accounted for just over a quarter of installed capacity (28.1%) followed by India (8.8%), with the rest of the world accounting for nearly two-thirds of installed capacity.

Chart 2.1: Installed long stapled spindles (millions), 1990-2020



Source: IWTO (2022).

2.2.4 Textile production

Once spun, wool and other natural fibres are processed into textiles for a range of consumer markets. Commonly textile consumer markets are grouped into three processing activities:

- **weaving** - a series of processes which converts yarn into a fabric that is suitable for tailoring via interlacing two sets of yarns on a loom
- **knitting** – conversion of yarn into fabric by bending yarn into loops which are then intermeshed with other loops of the same configuration
- **wool carpet manufacturing** - textile floor covering with a top layer comprised of multiple yarn segments, arranged in a compact formation as short loops or upright tufts.[9]

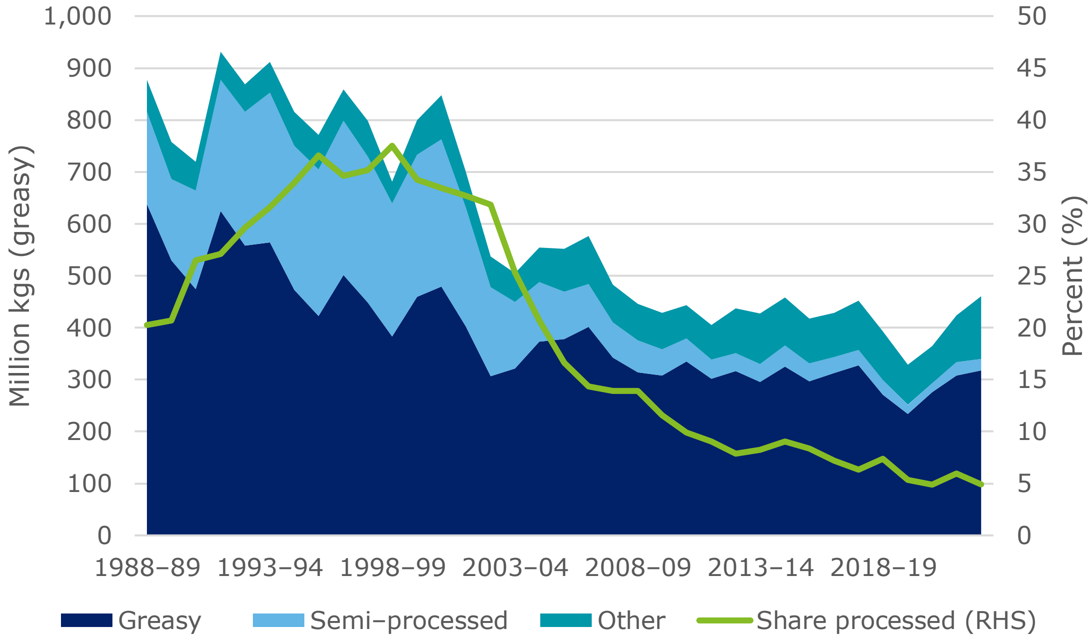
Reflecting the diverse array of applications of wool in textiles, processing occurs around the world. China is a major producer across most products, but countries like India and New Zealand (particularly for carpets), and Italy and other parts of Europe (for knitwear and apparel) are also significant suppliers. Collectively, these globally diverse producers supply consumers around the world, with most trade focussed on high income markets with large populations such as the United States, Europe, and Japan.[10]

2.3 Australian wool processing moved offshore and consolidated

While significant in a domestic and global context, Australia's wool industry has undergone dramatic change in recent decades. Since 2000, the volume of wool produced and exported in Australia has declined by around 50%. This reduction was driven by contracting sheep numbers and farmers, which declined at similar rates during this period. This, in turn was driven by a range of market and policy factors, including the collapse of the Reserve Price Scheme and the intensifying competition from alternative textile materials (i.e., cotton and synthetic fabrics).

[9] There are three main methods of making wool (and wool rich) carpets and rugs: hand-knotting, weaving, and tufting.
[10] International Wool Textile Organisation (IWTO), Market Information (Edition 17: 2022), Prepared by Poimena Analysis & Delta Consultants

Figure 2.2: Australian wool exports and share processed in Australia



Source: ABS[24]

Most of the contraction in Australian wool exports has been in early-stage processed wool. Compared to volumes in 2000, Australian ESP wool exports were, 90% or 250 million kilograms lower in 2022-23. This segment of the supply chain largely moved offshore, particularly to China where low-cost labour underpinned a broader expansion in the country's manufacturing. While the Australian government had begun to reduce direct support for local textile and clothing industries in the 1980s, further reductions were made in the years after 2000 with effective rates of assistance for textile industry falling from around 35% to 25%.

In the past, Australia has had a relatively large and diversified early-stage processing industry, with a range of specialised and integrated scouring and top making operations in locations across Australia. In 2003, there were 15 ESP companies in Australia, although almost all these wool processing factories shut down between 2003 and 2010.

Today the ESP industry is principally comprised of three companies located across Victoria and South Australia. The largest of these is Michell Wool Pty Ltd, which supplies both scoured and carbonised wool.[11] The remaining Australian processors are Victorian Wool Processors, who predominantly supply carbonised wool, and E.P Robinsons which supplies both scoured and carbonised wool, with both businesses operating on a commission basis. Collectively Australia's wool ESP industry is estimated to have generated $165 million in revenue and employ around 260 people in 2021-22.

2.4 Australian wool heavily concentrated on raw exports to a single market

Reflecting the contraction in Australian ESP, effectively all of Australia's wool trade is now exported in a raw greasy state. In 2022-23 only 6%, or 22.5 million kilograms, of Australian wool exports was processed. The remainder is shipped as 'greasy' wool, with no processing undertaken in Australia.

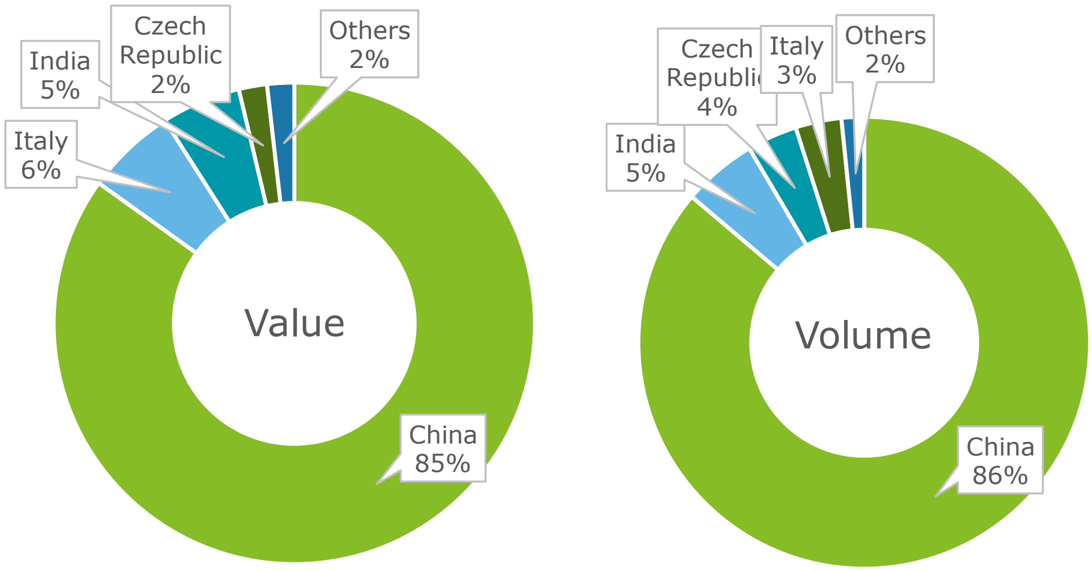
Australia's greasy wool exports are almost solely shipped to China; with that market accounting for 85% of the value of trade in 2022. The next largest markets for Australian greasy wool exports that year were Italy (6%), India (5%) and Czechia (2%).

The concentration of exports to the market in part reflect a broader concentration of textile manufacturing capacity in China. According to the International Wool Textile Organisation (IWTO),[10] China accounts for 28% of the world's installed 'long-stapled spindles', most of which was installed between 1990 and 2010.[12] This

[11] Michell Wool also manage a wool scour in China and are involved in other aspects of the supply chain in Australia, including exporting broking.
[12] Manufacturing components used to spin or twist fibres in the textile industry.

expansion in capacity, occurred alongside the decline in Australia's textile and wool manufacturing capacity and was underpinned by strategic efforts by the Chinese government to develop local industry.[13]

Figure 2.3: Australian greasy wool value and volume exports by major destination, 2022



Source: ABS[24]

China's manufacturing industry is supported by Australia as the major global supplier of wool in much the same way Australian wool is supported by China as the major global processor.[14] The relationship between the Australian and Chinese wool industries is developed, strong, and symbiotic.[15] Indeed, some stakeholders surveyed during Phase 1 of this project saw China as holding the wool supply chain together amidst the background of the Global Financial Crisis. The beneficial relationship is underpinned by factors such as:

- efficient logistics connections (close sea-freight proximity and substantial backfilling opportunities[16])
- strong economic growth
- urbanisation (which supports wool product demand)
- acceptable trading conditions (including availability of credit insurance
- arbitration avenues
- relatively low manufacturing costs (in part due to lower labour costs).

[13] In particular the Chinese government imposed differing tariff rates on raw and processed wool imports
[14] Alongside direct stakeholder engagement, the Australia-China Joint Wool Working Group, industry from both countries hold constructive conversations that formalise concerns and seek to derive solutions to any problems that may be encountered.
[15] WoolProducers Australia, submission to the Inquiry into diversifying Australia's Trade and Investment Profile
[16] As China is a major exporter of containerised trade to Australia, and Australia exports limited containerised products (outside of wool) to China there are substantially opportunities to 'back fill' empty containers that require returning to China.

3 Case for Change

This chapter details the case for change for the Australian wool supply chain. In line with Infrastructure Australia's Assessment Framework[17] , this chapter first identifies specific problems and opportunities with the status quo and details their underlying cause. The impact of these problems and opportunities are quantified so as to demonstrate their significance, and then assessed against stated public policy goals and objectives. Collectively this chapter supports the Government's ability to quantify infrastructure investment as part of long-term planning processes.

3.1 Problems and opportunities for the current wool supply chain

As outlined in Chapter 2, the current structure of the wool supply chain has been advantageous in many regards. However recent global events have highlighted exposure to disruptive risk for the Australian wool industry. These events include geopolitical tensions between Australia and China supply chain disruptions, as well as the disruptive impact of COVID-19. A summary of the identified problems and opportunities are illustrated below in Figure 3.1, before they are discussed in further detail in the following sections.

Figure 3.1 Summary of identified problems and opportunities

Source: Deloitte Access Economics

3.1.2 Problem 1: Animal disease outbreak risks

The most significant disruption risk is assessed as an animal disease event such as a foot-and-mouth disease outbreak in Australia. Australia is free of many of the world's worst animal diseases and an outbreak could impact on-farm operations, regulatory control, and access to export markets. The configuration of the current wool supply chain underpins the materiality of this risk, because the overwhelming bulk of wool trade is raw (unprocessed) and concentrated with a single market.

Were an animal disease outbreak to occur in Australia, trade consistent with the World Organisation for Animal Health's (WOAH) Terrestrial Animal Health Code[18] could only proceed if raw greasy wool is stored at the following temperature timing combinations:

- 4°C for four months,
- 18°C for four weeks or
- 37°C for eight days.

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[17] Infrastructure Australia, Assessment Framework: Stage 1 - Defining problems and opportunities<https://www.infrastructureaustralia.gov.au/stage-1-defining-problems-and-opportunities>
[18] WOAH, Terrestrial Animal Health Code, Chapter 8.8 <https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/current/chapitre_fmd.pdf >

No part of the wool supply chain is currently set up to store wool in a temperature-controlled environment. The time periods listed above are material increases for the supply chain. Information provided by industry advise that under typical supply chain conditions, the time elapsing in transporting greasy wool from farm and exporting to China currently takes around 5 weeks.[19]

The quarantine times outlined above would consequently be a significant challenge for some wool supply chain participants. In particular, wool exporters are assessed as being the immediate part of the supply chain exposed to these risks and most significantly at risk. This segment of the supply chain initially pays farmers and take possession of the wool until it is delivered to the buyer in the importing country, at which point the exporter is paid. Such delays require exporters requires them to carry debt for longer periods than usual and reduces cashflow. The principal effect of this is that exporters cannot buy as readily as they could previously and that they are exposed for longer periods to trading risks such as price or basis movements, as well as counter party or country risks.

For wool processed in Australia, an animal disease outbreak could see trade continue largely uninterrupted. This is because according to the WOAH Code industrial washing and scouring (i.e., wet processing)[20] are procedures that should be used to inactivate foot and mouth disease in wool for industrial use. Critically though, only 5% (Figure 2.2) of Australia's wool production is currently processed in Australia and therefore able to effectively manage the risk of an animal disease outbreak in Australia.

The risk of such an animal disease outbreak to wool trade was highlighted in 2022 when South Africa's wool supply chain (which is dominated by greasy exports like Australia) lost critical market access with its major trading partners following a Foot and Mouth Disease (FMD) outbreak (see Box 1 for more detail).

Box 1: Market access for South African wool following FMD outbreaks

South Africa's wool industry is focussed on producing fine (and superfine) wool from merino breeds. In 2020-21 South Africa exported a total of 55.3 million kg of wool, effectively all of which was greasy unprocessed product. China is the single largest destination for South African wool (44.0 million kg in 2020-21) with the remainder mostly sent to the Czech Republic (6.5 million kg).

In 2019 South Africa lost WOAH recognition of FMD-free status. Following this, the South African government negotiated agreements with trading partners on the export of safe commodities, including scoured wool. While these agreements allowed for a continuation of trade, South Africa's major wool export market in China (which is not listed as free from FMD or as having an FMD free zone with WOAH) continued to implement trade restrictions. South Africa negotiated restoration of market access to China in 2019 based on the storage parameters in the WOAH Terrestrial code.[21] This includes different combinations of heat treatment and storage length that effectively resulted in delays and storage costs for the supply chain.

More recently on April 11, 2022, the South African government announced that it was attempting to control an FMD outbreak in five provinces. China subsequently announced a restriction on the import of all South African cloven-hoofed animals and their products due to the outbreak.[22] This included both raw greasy and processed wool with the announcement also declaring that exports would resume once new measures were implemented, including Chinese registration of export facilities and inactivation of the FMD virus.

In May 2022, China signalled that processed wool (scoured) from South Africa would be eligible to be imported into China. This effectively recognised the treatment regimens agreed under the WOAH Terrestrial code. In late August 2022, over 3.5 months following the outbreak, China removed its ban on South African wool exports.

3.1.3 Problem 2: Export market country risk

Alongside the risk of an animal disease outbreak, the Australian wool supply chain faces unique risks from policy decisions in its trading partner countries. Were Australian wool's major export partner to impose new tariff or non-tariff measures effectively all trade would incur additional costs imposed. This exposure is unique in an Australian context for two reasons: export market concentration and market substitutability.

As outlined earlier in this report, China is the largest market for Australian wool by a considerable margin. This is different than most other Australian agricultural exports, where trade is more diversified across a range of

[19] Processing in overseas markets and transport to latter stage processing is estimated to take an additional 13 weeks meaning the total time elapsed for wool from farm to latter stage processing is around 18 weeks.

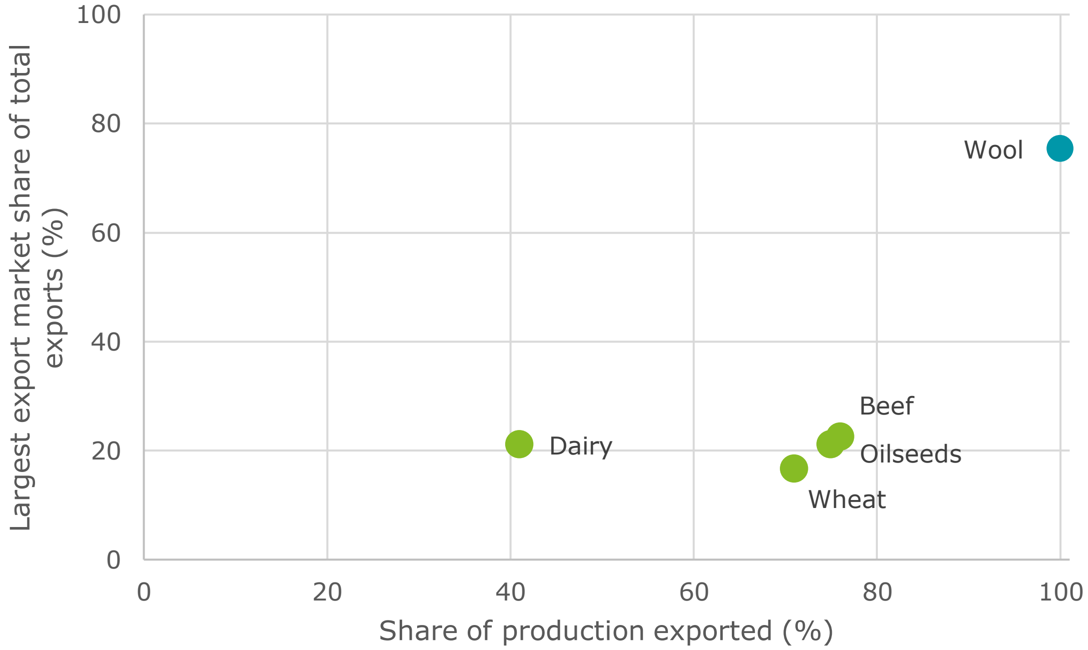
[20] which consists of the immersion of wool in a water-soluble detergent held at 60-70°C

[21] i.e. Storage at 4°C for 4 months, 18°C for 4 weeks or 37°C for 8 days

[22] Across other trading partners, wool trade with South Africa in 2022 was unaffected with Europe (including for Italy, Czechia and Bulgaria which are listed as FMD free where vaccination is not practiced); and allowed to India (where FMD is endemic) if certified from FMD free zones.

export markets. Over the last 10-years China has accounted for 75% of the total value of Australian wool exports with the remainder consisting of many smaller partners. There is no material Australian domestic market to supply. This compares with most other exported Australian agricultural products where the largest trading partner accounts for a significantly smaller share of exports, and where exports are also complemented by a local market that is materially large (Chart 3.1). Australia's most valuable exports of beef and wheat for example, both export around 70% of production and where the largest market only accounts for approximately 20% of trade.

Chart 3.1: Share of production exported and largest export market share, selected Australian agricultural commodities



Source: Deloitte Access Economics using ABARES[23] and ABS[24] data

The problem of importing or partner country risk is partially illustrated in Box 2, which describes how relatively recent importing country policy changes affected Australian wine and barley exports. In contrast to these commodities, and many other of Australia's agricultural exports, wool does not have the potential to easily substitute to alternative partners meaning the consequences of importing country risk is likely higher with fewer potential alternatives.

As a globally connected supply chain, wool is also exposed to country risk further down the supply chain. This is illustrated in Box 3, which describes the recent US-China trade war, focussing on apparel and textile industries.

Where most other Australian agricultural exports supply domestic consumer markets in importing countries, Australia's wool exports are destined for industrial processing. This processing requires the installation of highly specific processing machinery and other capital works that are concentrated in selected areas of the world.[25] Wool's processing as with textile processing more generally is concentrated mainly in China as demonstrated by the country's share of installed long staple spindles, a specific component of textile processing. Between 1990 and 2020 China is estimated to account for 28% of installed capacity, with India the next largest and having around a third of the capacity of China (Chart 2.1).

[23] ABARES, Share of agricultural production exported (2017)

[24] ABS, International Merchandise Trade (2023)

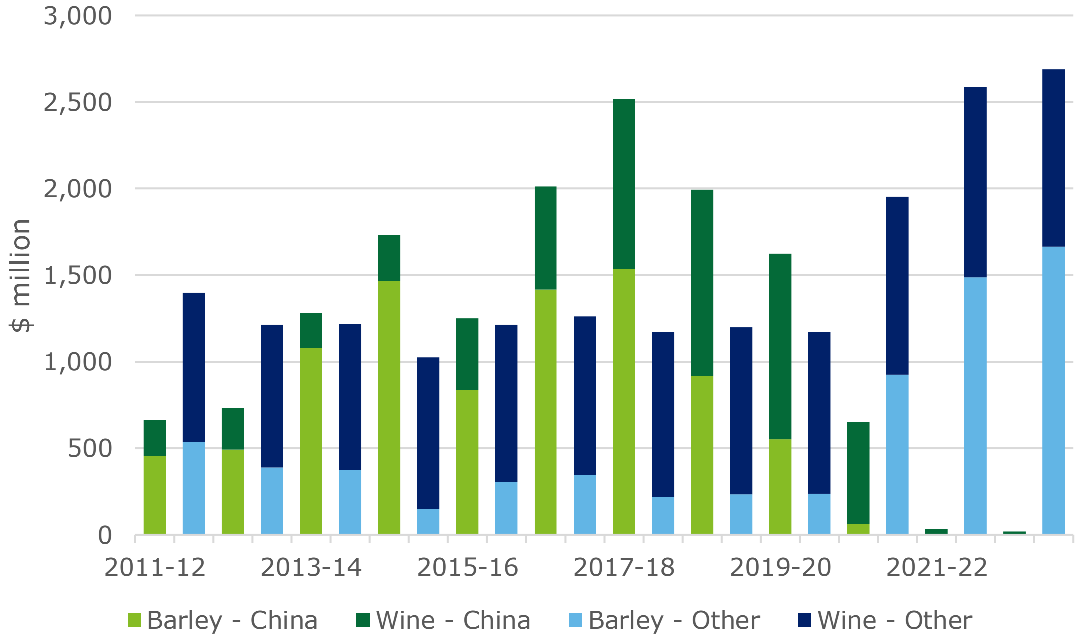
[25] Cotton faces similar industrial use constraints, however the installed capacity geographically more diverse.

Box 2: Trading partner country risk: Chinese tariffs on Australian exports

In May 2020, the Chinese government imposed an 80.5% anti-dumping and countervailing duties on Australian barley. This was followed by provisional anti-dumping measures on Australian wine exports of between 107 per cent and 212 per cent in November 2020. While the Chinese government announced the removal of these duties in 2023, their impact has been material and particularly significant for the bilateral trade flows of these specific commodities.

The effect of the tariff on Australian exports is illustrated in Chart 3.2 which describes Australian exports of barley and wine to China and all other markets before and after the imposition of these tariffs. In 2019-20, Australia exported $550 million of barley to China and $1.0 billion in wine. In the first full year in which the dumping and countervailing tariffs were in place, exports of barley totalled just $63 million (12% of that in the previous year) while wine exports effectively halved in 2020-21 (to $586 million) before shrinking to just $35 million in 2021-22.

Chart 3.2: Australian exports of Wine and Barley to China and all other markets



Source: ABS[24]

While the effect of these imposed tariffs was material for direct flows to China, supply chains were largely able to find alternative markets, albeit with lower prices on average. Total wine exports were not able to fully replace its largest market with the value of trade in the three years since the imposition of tariffs around 25% lower. In contrast, improved seasonal conditions saw barley production expand dramatically after 2019-20, even without its previously largest market.

Box 3: Downstream country risk: US tariffs on Chinese exports

Starting in 2018, the Trump Administration announced significant changes in tariff actions on a variety of US imports. This led to several rounds of tit-for-tat retaliation with China until US tariffs covered nearly all Chinese imports.

Among the affected products were Chinese exports of textiles and apparel products. On 24 September 2018 the US initially imposed tariffs on imports from China of 10%, initially affected US$3.7 billion in trade. The measures were subsequently increased by an additional 25% on 10 May 2019 before the expansion of tariffs (of 15%) to a further US$31 billion of Chinese textile and apparel products on September 1, 2019 (Liu et al, 2023).[26]

This trade war had a significant effect on the US and China economies. Amiti, Redding, and Weinstein (2019)[27] for example found that the US tariffs costed importing companies and consumers an additional US$3.2 billion a month and generated US$1.4 billion a month in efficiency (deadweight) losses. This analysis also found the tariffs reduced the variety of products available, while other analysis found global commercial ties were destabilized, the diversion of trade to third parties and substantial delays and challenges for trade and investment transactions (Liu et al, 2023; Kwont, 2022).

The impact to US consumers is estimated to have been significant. The American Apparel and Footwear Association for example estimated that the duties would increase the cost of average annual purchases for a typical US family of four by least US$500. This materially affected US demand for textile products, with Stawaz-Grabowska and Wieloch (2023)[28] finding US imports across most products were lower due to the tariffs. In addition to 'finished' goods, the tariffs also increased prices for US manufacturers who import semi-processed goods and utilise equipment made in China – further entrenching the adverse conditions consumers were facing across supply and prices.

3.2 Opportunities for the current wool supply chain

Alongside the above-described problems, there are opportunities to advance key aspects of the wool supply chain. These objectives of these include advancing wool's environmental, sustainable and socially responsible credentials, as well as supporting supply chain innovation to underpin wool's long-term competitiveness. Each of these are discussed below in more detail.

3.2.1 Opportunity 1: Advancing wool's environmental, sustainable and socially responsible credentials

Across all global markets, consumers are becoming increasingly conscious about their purchasing decisions. Among the underlying forces driving change are demands for improved environmental, sustainable and socially responsible considerations. Textile and apparel supply chains are not apart from these dynamics, with the industry seeing greater pressure to communicate and evolve from consumers but also governments.

The pressure on textiles and apparel reflects in part the relatively significant footprint these supply chains cast. Clothing manufacturing and transportation produce a large volume of waste and high greenhouse gas emissions, often orientating production systems to developing countries with relatively lower labour costs and weaker labour protections.[29,30]

While impacts are generated throughout the supply chain, the processing stage is a material contributor to wool's environmental, sustainability and social responsibility credentials. Relative to the rest of the supply chain, global early-stage processing is a:

[26] Liu & Escalante, Timeline of the U.S.–China Trade Dispute and Tariffs on Cotton and Textile Trade (2022) https://extension.uga.edu/publications/detail.html?number=C1259&title=timeline-of-the-uschina-trade-dispute-and-tariffs-on-cotton-and-textile-trade#:~:text=May%2010%2C%202019%3A%20The%20U.S.,an%20increased%20rate%20of%2015%25.
[27] Amiti, Redding & Weinstein, The Impact of the 2018 Tariffs on Prices and Welfare (2019) https://www.aeaweb.org/articles?id=10.1257/jep.33.4.187
[28] Stawasz-Grabowska & Wieloch (2023) The United States–China Trade War: Timeline, Consequences, and Prospects for the US Economy. An Analysis Based on the Textile Industry https://dspace.uni.lodz.pl/bitstream/handle/11089/46511/147-170_Stawasz-Grabowska%2C_Wieloch.pdf?sequence=1&isAllowed=y
[29] Abbate, Centobelli, Cerchione, Nadeem & Ricco Sustainability trends and gaps in the textile, apparel and fashion industries (2023) https://link.springer.com/article/10.1007/s10668-022-02887-2#:~:text=Textile%2C%20apparel%2C%20and%20fashion%20(,cheap%20labor%20in%20developing%20countries.
[30] Hasan, Mehta & Sundaram (2021) The effects of labor regulation on firms and exports: Evidence from Indian apparel manufacturing<https://www.sciencedirect.com/science/article/abs/pii/S0147596720300214>

- significant fossil fuel user through the combustion of gas for thermal heating and electricity to power machineries
- major consumer of water in scouring
- large producer of waste, including both effluent and solid waste, and
- significant employer of low-cost labour in developing countries.

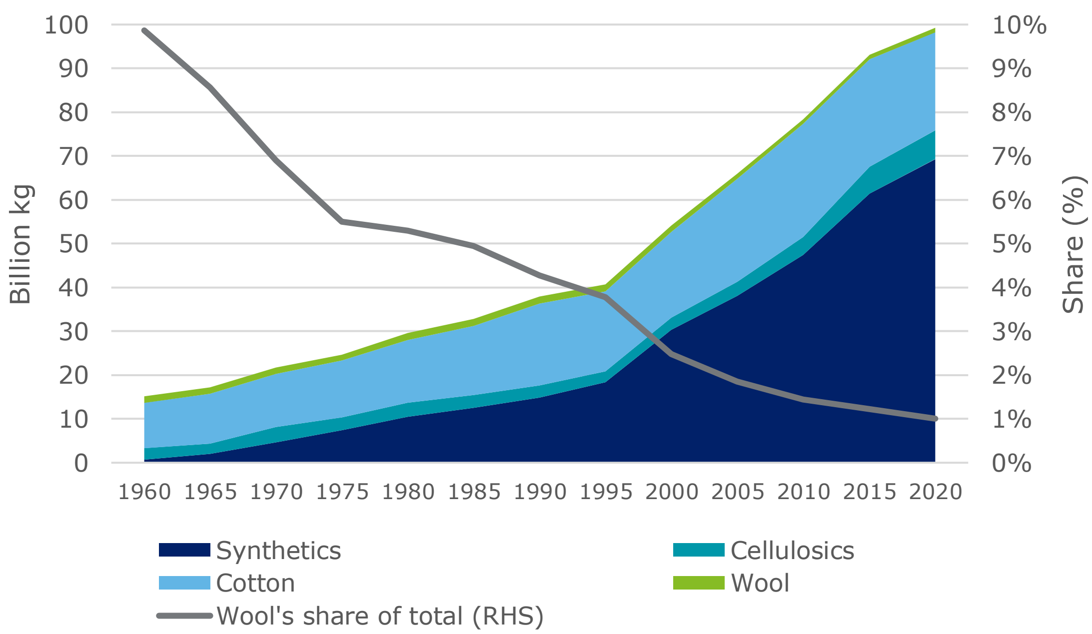
Early-stage processing is therefore a critical component for the wool supply chain as it strives to meet the expanding and evolving demands of global consumer markets. This opportunity is particularly relevant for early-stage processing in Australia which currently only accounts for a small share of the global market. Australia's economy ranks relatively strongly across environmental, sustainability and socially responsible outcomes being 40th in the UN's ranking of countries across its Sustainable Development Goals. Australia's performance is in large part due to its labour protection laws and advanced living standards, which it could leverage to strengthen the wool supply chains efforts in environmental and other outcome.

3.2.2 Opportunity 2: Supporting supply chain innovation

Innovation is crucially important across the economy, supporting the underlying competitiveness all the way from firms, through supply chains and for whole countries. Innovation is critical because it allows navigation of the ever-changing market forces that create opportunities and challenges within the economy.

For wool, the market environment has seen steadily strengthening competition over the long term. In the past 15 years, clothing manufacturing doubled, and wool is now considered a niche product accounting for just 1.2% of the global textile market (IWTO, 2018; Chart 3.3).

Chart 3.3: Global textile production by fibre and wool's share of total



Source: IWTO[5]

The strengthening of competition is in part the result of innovations in the textiles market that has seen synthetic fibres emerge as low cost and flexible alternatives (Remy et al. 2016[31]). It also reflects changes in consumer demand that have seen demand for traditional markets of outer knitwear and woven suits soften as a result of cultural and consumer preference changes.[32]

To survive in this increasingly competitive market, the wool supply chain has had to continue to innovate with some advanced outcomes that provide real future opportunities. Recent examples include the emergence of

[31] Wiedemann, S., Biggs, L., Nebel, B. et al. Environmental impacts associated with the production, use, and end-of-life of a woollen garment. Int J Life Cycle Assess 25, 1486–1499 (2020). https://link.springer.com/article/10.1007/s11367-020-01766-0#ref-CR49.

[32] Doyle, Preston, McGregor& Hynd, The science behind the wool industry (2021). The importance and value of wool production from sheep, Animal Frontiers, Volume 11, Issue 2, Pages 15–23, https://academic.oup.com/af/article/11/2/15/6276818

wool into high value and rapidly expanding active and leisure wear markets. These markets are significant opportunities not only because strong demand is supporting strong general growth, but also because wool's natural characteristics closely meet consumer needs. In particular consumer demand for attributes such as breathability, resisting odour, and moisture-wicking capabilities can be supplied from fine diameter wools (less than 18 μm) that enable products to be worn close to skin.

Early-stage processing as a critical link between the farm and end consumer is seen as central to supply chain innovation and therefore the long-term competitiveness of wool. However wool industry participants have often voiced the view early-stage processing has not engaged in innovation as readily as the rest of the supply chain. This is in part perceived to be the result of the early-stage processing being mostly performed geographically far from either the farm or consumer – effectively removed from key drivers of innovation. There may therefore be an opportunity to support a more innovative environment in early-stage processing by considering change from the current supply chain structure.

3.3 Underlying causes of problems and opportunities and impacts of no change

3.3.1 Underlying causes

The identified problems and opportunities stem from the current configuration of the supply chain, namely:

- the focus on exporting raw, unprocessed product
- the concentration of exports with a single market.

For individual businesses current supply chain configurations are a commercially viable and rational structure. The 1990s and 2000s effectively saw all the wool supply chain collectively adopt this supply chain principally to reduce labour use costs. The cumulative effect of this has been to expose the whole wool industry to risks from animal disease events and overseas country policy decisions. As described earlier and again detailed in Chart 3.4 below, in the last 5 years, unprocessed wool accounted for 94% of the value of trade. Of this, China accounted for 79%. Only 6% of the total value of trade was processed during this period.[33] Raw animal products, including wool, are more exposed to the risk of trade disruption from animal disease events than processed goods. As Australian trade focusses heavily on exports of unprocessed greasy wool, the bulk of the supply chain is at risk in the event of an animal disease outbreak in Australia. Relatedly, the concentration in trading partners means the wool industry is heavily exposed to policy changes in its major partner with diversification of such risks not currently available under the current supply chain structure.

Chart 3.4: Processed and unprocessed proportions of the value of Australian wool exports

Source: ABS
Note: Early stage processed wool to China accounts for 0.2% of total exports

[33] Of this processed portion, China accounts for a further 0.2% of trade.

3.3.2 Impacts of not addressing identified problems and opportunities

The risks of not diversifying the wool supply chain are real and material. In Phase 1, Deloitte Access Economics (2022) modelled the impact to the Australian economy of selected risks that result from the existing structure of its supply chain.

The potential impacts of the supply chain risks were analysed in Deloitte Access Economics' Computable General Equilibrium model (DAE-RGEM). Each risk scenario was analysed by comparing a base case that represents the status quo — where wool is principally exported as greasy product to China — against a policy scenario where supply chain risks are assumed to eventuate.

Five stylised scenarios were considered, covering changes to importing country tariffs, non-tariff measures and an outbreak of foot and mouth disease in Australia. A summary of the results is provided in Table 3.1, with impacts ranging from $60 million per annum (price effect Non-tariff Measure: NTM) to a $2.1 billion reduction in wool output (peak year animal disease outbreak scenario). Each scenario is described in more detail in the following sections.

Table 3.1: Impact of tariff imposition on greasy wool exports, summary results

Risk	Scenario	Peak impact to wool output	Relative impact
Tariff changes	14.7% tariff applied and reduced over six years	-$725 million	22% reduction
	80.5% tariff applied and remains in place	-$1.1 billion	34% reduction
Non-tariff measures	1.0% increase in cost of exporting	-$60 million	1.8% reduction
	5-year market access ban	-$1.2 billion	51% reduction
Animal disease outbreak in Australia	Loss of market access Higher capital costs Reduced productivity	-$2.1 billion	89% reduction

Source: DAE-RGEM (2022).

3.3.2.2 Tariff increases

Two separate baseline tariff increases were modelled to illustrate varying impacts across both scope and timing. A smaller tariff of 14.7% that is assumed to be removed after six years is assumed to be applied by China to imports of Australian greasy wool. This tariff increases are comparable to that imposed by the US and Chinese governments during the US-China trade war. A relatively larger tariff (of 80.5%) was also modelled and was assumed not to be removed.

The introduction of an 80.5% tariff that is applied to Australian greasy wool exports and assumed to remain in place for the modelled horizon (to 2050) is projected to result in a similarly large reduction in Australian wool output. In 2037, when the tariff is introduced, wool output is estimated to decline by around 34%. This equates to a loss of revenue of around $1.1 billion per annum in affected years for the wool industry.

As with the smaller tariff, the avoided loss in industry output is valued at around $741 million in the peak year. However, as the 80.5% tariff has a much larger impact on Australian wool, industry output is still estimated to be lower in affected years in the policy scenario.

3.3.2.3 Non-tariff measures

In contrast to tariffs, which are a tax applied to traded goods, there are a range of ways non-tariff measures (NTMs) can be applied. Broadly though these can be summarised as either having price or quantity effects.[34,35] Reflecting this, both price and quantity NTM risk scenarios were modelled as affecting the wool supply chain.

The price NTM considered an increase in trading costs of 1% mimicking costs such as quarantine delays or increased documentary burden.[36] The quantity NTM considering a loss of market access and aimed to mimic Sanitary and Phytosanitary type controls that can see trade halted as importing countries look to control biosecurity risks. The price affecting NTM is assumed to be maintained for five years, while the quantity NTM is assumed to be introduced without being removed over the modelling horizon.

The impact to Australia's wool output the event of a 14.7% tariff on greasy wool exports. In the peak affected year, the introduced tariff is estimated to reduce the value of industry output by 22%. This equates to lost output of around $725 million per annum.

The introduction of a quantity NTM that completely restricts export access to a specific market and is permanently applied to Australian greasy wool exports is projected to result in significant reduction in Australian wool industry output. At the time the NTM is imposed, wool output is estimated to decline by around 51% or $1.2 billion per annum.

3.3.2.4 Animal disease event in Australia

This scenario analysed the impact to the Australian wool industry of an animal disease outbreak such as FMD in Australia. In DAE-RGEM model, the animal disease outbreak was represented by a series of shocks to wool and other livestock industries. These shocks included reduced demand in export markets, higher capital (from animal destruction) and operational costs (e.g. vaccination regimes), and were informed by ABARES (2013)[37,38] modelling.

The estimated impact of in Australia is estimated to have a significant impact on wool output. The impact to Australia's wool industry is an estimated reduction in output of $1.2 billion per annum on average. This result is marginally higher than that for the permanent quantity NTM and reflects the similarity in outcomes for the export supply chain driven by major loss of market access. An outbreak of FMD is slightly more costly for the wool industry in terms of output, because of the additional impacts to control costs and capital productivity.

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[34] UNCTAD, Introduction to NTMs <https://unctad.org/topic/trade-analysis/non-tariff-measures/NTMs-Introduction>

[35] See for example OECD, Estimating Ad Valorem Equivalents of Non-Tariff Measures (2018) <https://www.oecd-ilibrary.org/trade/estimating-ad-valorem-equivalents-of-non-tariff-measures_f3cd5bdc-en>

[36] This was informed by the average difference in relative ad valorem equivalents is applied to wool and other agricultural commodities that face a greater number of NTMs on average.[36,36]

[37] ABARES, Consequences of a foot and mouth disease outbreak <https://www.agriculture.gov.au/abares/research-topics/biosecurity/biosecurity-economics/consequences-foot-mouth-disease-outbreak>.

[38] Selected aspects of this modelling were updated in 2022, including for example the discount rate

3.4 Strategic Alignment

Increasing the wool supply chain's ability to manage the risks associated with its current supply chain configuration aligns with a range of strategic objectives across the Australian policy landscape. Key strategic policies and programs are outlined in this section and includes ongoing[39] Commonwealth government initiatives that are domestically (e.g., National Reconstruction Fund) or internationally focused (e.g. Australia-India Business Exchange). Diversification of the wool supply chain also strategically aligns with broader policy efforts by the Commonwealth government announced as part of Ag2030 or the Federal budget. It also aligns with services provided by commonwealth and state governments that aim to support export industries by providing specific market services.

National Reconstruction Fund

The Australian Government has committed $15 billion to establish the National Reconstruction Fund (NRF). The NRF will provide finance for projects that diversify and transform Australia's industry and economy. The NRF has a planned focus on targeted investments in areas including value-add in agriculture, forestry and fisheries. The principal objective in this area is to encourage investment in value adding and growing exports, help diversify the sector and open up new possibilities for trade.

The problems and opportunities identified as part of this project are closely aligned with the objectives of the NRF. In particular the principal problems identified are underpinned by a lack of diversification that the NFR aims to deliver. Moreover, Australia's wool supply chain also aligns with the objective of delivering further value-added as the current wool supply chain focuses on exporting raw greasy wool without any processing that value-adds in Australia.

Overseas partnerships

As wool's supply chain is focussed on exports, diversification of risks strategically aligns with the commonwealth government's objectives of engaging in bilateral trade and investment partnerships. One such example is the Australia-India Business Exchange (AIBX) a four-year program to boost trade and investment between India and Australia. The program highlights opportunities for Agrifood and provides access to the latest insights and opportunities introductions and connections in India pathways to commercial partnerships access to advisers in major Indian cities.

Ag2030 roadmap: Australian Agriculture's Plan for a $100 Billion Industry

The 2030 Roadmap is a consolidated plan for Australia's agricultural industry developed by the National Farmers Federation and is supported by the Australian Government.[40] It describes aspirational goals out to 2030 and is centred on a headline growth target of $100 billion. The roadmap extends beyond this goal aiming to deliver for communities and the environment with government efforts focused on key themes including the Strengthening of agricultural ties with major and emerging export markets and delivering new trade and market access for producers.

Trade and investment services programs

The commonwealth government and most Australian state governments offer trade and investment services. These programs are delivered by organisations such as the Australian Trade and Investment Commission (Austrade) or Global Victoria and aim to help grow Australia's prosperity by supporting quality trade and investment outcomes for businesses.

Examples of programs delivered by these organisations include Austrade's Export Market Development Grants (EMDG) program which aims to help Australian businesses expand their export footprint. Since 1974, EMDG has supported more than 50,000 Australian businesses assisting them to market and promote their products to more than 180 countries.

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[39] One recently closed commonwealth program was the Australian Government's Agricultural Trade and Market Access Cooperation (ATMAC) program which provided grants for projects that harnessed opportunities to access new markets and strengthen market presence through existing channels for agricultural commodities affected by market disruptions and which have restricted access to key destination markets.

[40] Department of Agriculture, Ag:2030 <https://www.agriculture.gov.au/sites/default/files/documents/ag-2030.pdf>

4 Options Development

Options to address the identified risks include infrastructure responses that incorporate wet processing of wool for the worsted system. Several locations are shortlisted options including regions with processing capacity (i.e., metropolitan Victoria and South Australia) and those where processing previously existed (e.g., regional NSW).

4.1 Objectives and methodology

This chapter identifies selected options that could support the Australian wool industry in addressing the risks and opportunities identified in Chapter 3. The approach to identifying options involves three key steps. Firstly, potential responses are analysed, assessing the merits of policy and infrastructural responses. Second an key issues to support an infrastructure response are assessed, with the last step involving an analysis of geographic locations (which involves multiple sub-steps including a multi-criteria analysis and a risk assessment).

The shortlisting process is illustrated in Figure 4.1. Subsequent sections in this chapter detail each step (and the sub-steps) used to assess domestic processing options, focussing on facility location, scale and processing capability.

Figure 4.1: Overview of methodology options development shortlist

4.2 Identifying the most appropriate strategic response

There are several possible strategic responses to address the risks faced by the Australian wool supply chain. Three courses of action were identified including the base case. The identified responses are detailed below and were evaluated against addressing the identified problems and opportunities of addressing existing risks faced by the wool supply chain.

- the **Base Case** otherwise known as the status quo where no changes are made to the current supply chain
- an **infrastructural response** involves the provision of support to expand the capacity of wool processing in Australia
- a **policy response** includes other policy responses including establishing bilateral trade agreements, supporting international economic development, overseas export marketing services.

Under the **Base Case** no changes would occur to the current wool supply chain, with trade continuing to be focused on exporting raw wool principally to a single country. In this case, the wool supply chain remains subject to the identified risks as per the status quo. As such the Base case is not considered a practical strategic response and is not progressed for further options development.

An **infrastructure** response was found to directly support addressing the problems and opportunities. Any additional wet processing capacity in Australia would actively addressing risks associated with animal disease events because trade could continue according to WOAH international standards (where wool scouring inactivates the FMD virus). Such a response would also provide an opportunity to address risks from a concentration of trading partners by restructuring the supply chain. An infrastructure response could also provide opportunities to advance the supply chain's environment and sustainability credentials, and support supply chain innovation. Because of this, an infrastructure response is considered as a strategic response progressed for further options development.

A **policy** response was found to be complementary to a domestic infrastructural response, but not independently sufficient for addressing the problems and opportunities. Through stakeholder consultation and the first Phase of work, policy responses were assessed being the most appropriate avenue for engaging with international supply chain participants. These policy responses have been developed in parallel to this business case via a series of Road Maps which include recommendations that aim to strengthen diversification opportunities for Australian wool in emerging and novel of Vietnam, India and Bangladesh. Appendix D details the road map recommendations and as a result these measures are not considered in detail in this business case.

4.3 Infrastructure response: capability assessment

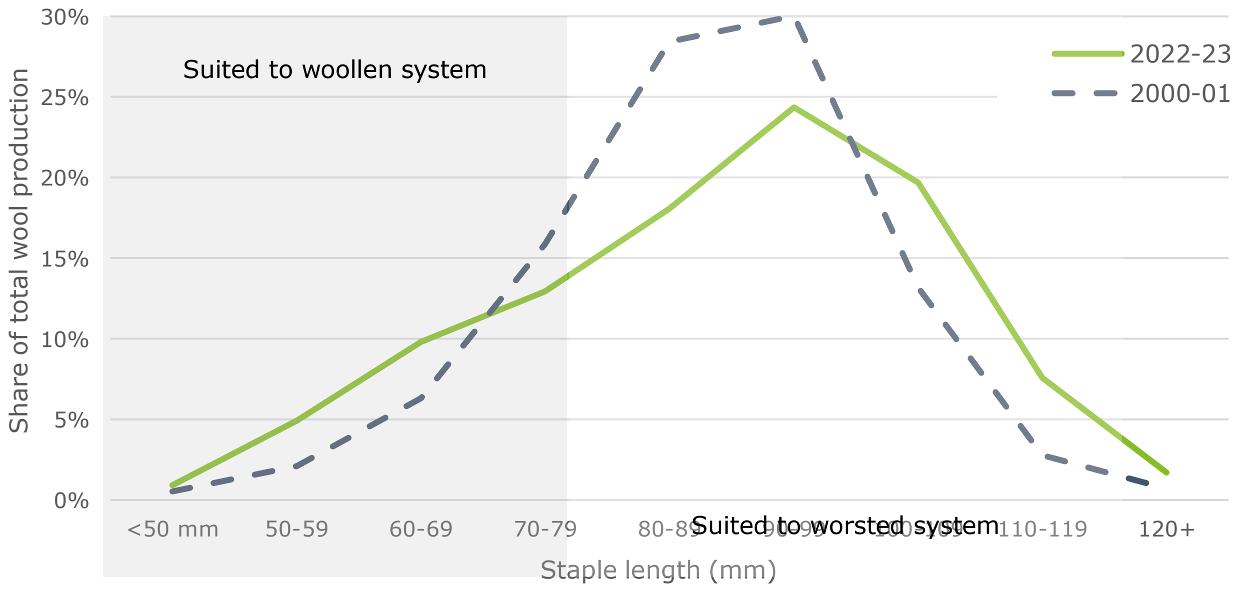
There are a number of potential capabilities that an infrastructure response could deliver. Among the considerations are the type of wool processed (and relatedly what markets are serviced via the worsted or woollen system), what specific technical activities are performed (either wet, dry or wet and dry processing), as well as the overall capacity (i.e., scale of processing throughput). This section analyses how the identified problems and options might be supported by specific capability considerations for an infrastructure response.

4.3.1 Processing system and markets (Worsted or woollen)

The first aspect to consider in the assessment of processing activities is the type of wool processed and the resulting market that is serviced. As detailed in Chapter 3, there are two types of wool processing systems: the worsted system and the woollen system.

Most of the Australia's wool is suited to the worsted system with the smaller share suited to woollen processing. In 2022-23, 71.4% of Australia's clip (approximately 165 million kilograms) was of staple length greater than 79mm, with worsted processing requiring longer fibre lengths. The remaining 28.6% of relatively shorter length fibres (less than 79mm) is suited to woollen system (Chart 4.1).

Chart 4.1: Distribution of Australia's wool clip by staple length

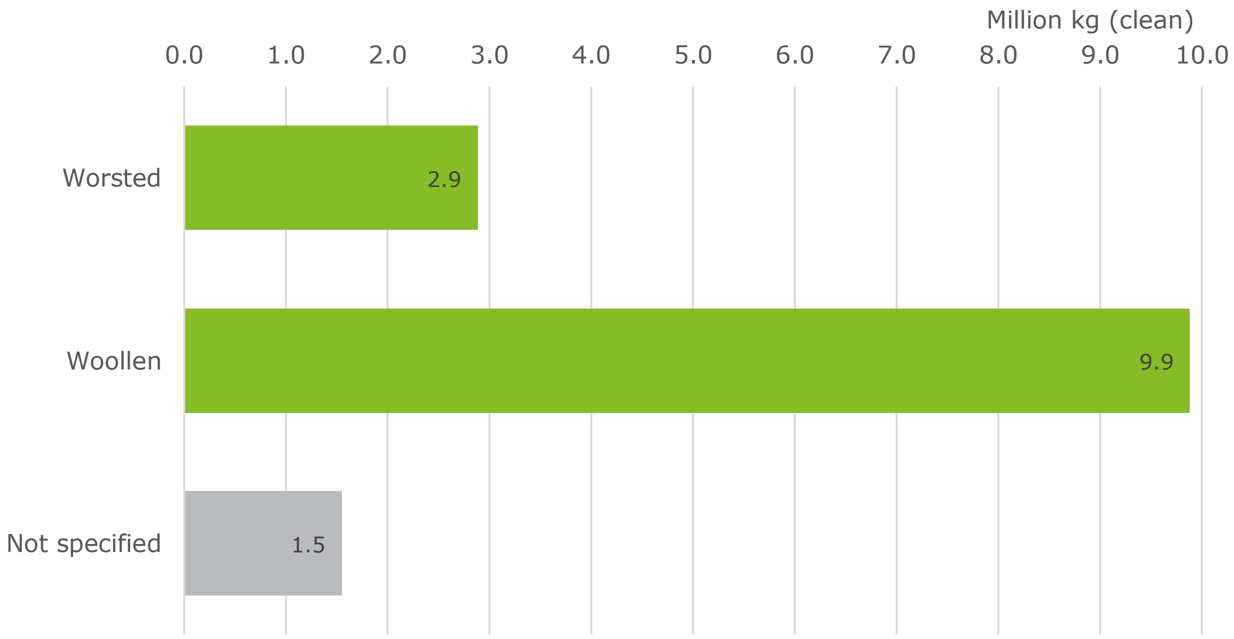


Source: AWTA Key Test Data[41]

[41] AWTA, Key Test Data (2023) <https://www.awtawooltesting.com.au/index.php/en/statistics/key-test-data-new>

Currently most wool processed in Australia is exported and supplied to the woollen system. In the period 2022-23 at least 9.9 million kilograms (clean) was exported for further woollen processing. A further 1.5 million kilograms is exported to an unknown mix of worsted or woollen processing. This indicates woollen exports lie somewhere between 9.9 million kilograms and 11.4 million kilograms. During the same period processed exports destined for the worsted system were estimated to total between 2.9 million kilograms and 4.4 million kilograms, from a known total of 2.9 million kilograms (Chart 4.2).

Chart 4.2: Estimated Australian exports by processing system



Source: ACWP, based of ABS[24] data

Relative to the total clip, this suggests that 14.8 to 17.1% of Australia's wool suitable for the woollen system is already processed in Australia. This contrasts with wool suited for the worsted system, with just 1.7% to 2.6% of the potential clip processed in Australia. The share of wool entering each of these systems that is processed in Australia is low. However, given the bulk of production focuses on the worsted system and processing is especially low, additional processing of worsted wool in Australia would more practically support addressing the problems and opportunities. For this reason, further options analysis considers a worsted system only – although additional woollen processing could also support supply chain risk management.

Table 4.1: Summary outcomes for consideration of wool processing system and markets

	Worsted system	Woollen system
Progressed for further analysis	✓	✗

4.3.2 Wool processing activities (wet or dry or both)

In addition to the specific supply chains and markets, an infrastructure response can also undertake various steps within the full set of processing activities. As outlined in Chapter 3, early-stage processing in the worsted system includes wet, followed by dry processing. This section considers whether the infrastructure response supports addressing the problems and opportunities best by undertaking either:

- wet processing only (i.e., scouring)
- dry processing only (i.e., carding and combing)
- wet and dry processing together.

The specific processing activities are specifically relevant for Problem 1, Animal disease outbreak risks. This is because international standards detail how early-stage processing can effectively manage the spread of animal disease risks.

The WOAH Terrestrial Animal Health Code[42] (the Code) provides standards for the improvement of terrestrial animal health and welfare and veterinary public health around the world. The measures in the Code guide Veterinary Authorities in individual countries as they work to detection and control pathogenic agents and preventing their spread via international trade, while avoiding unjustified sanitary barriers to trade.

With particular reference to wool, Chapter 8.8 of the Code states: *"For the inactivation of (foot and mouth disease) present in wool and hair for industrial use, one of the following procedures should be used:*

1. industrial washing, which consists of the immersion of the wool in a series of baths of water, soap, and sodium hydroxide (soda) or potassium hydroxide (potash)
2. *chemical depilation by means of slaked lime or sodium sulphide*
3. *fumigation with formaldehyde in a hermetically sealed chamber for at least 24 hours*
4. *industrial scouring which consists of the immersion of wool in a water-soluble detergent held at 60-70°C; 5) for wool*
5. *storage of wool at 4°C for four months, 18°C for four weeks or 37°C for eight days.*

Wet processing of wool (i.e., scouring in a worsted system) is therefore internationally recognised as being an effective treatment for inactivating foot and mouth disease. An infrastructure response that includes wet processing would therefore support the management of Problem 1: Animal disease outbreak risks for the wool supply chain by providing an avenue for treatment in the event of an outbreak. As such either wet processing only or wet and dry processing together are viable infrastructure responses and progress for further options development.

An infrastructure response that delivered dry processing only would not address any of the identified opportunities or problems and is therefore not progressed for further options development.

Table 4.2: Summary outcomes for consideration of wool processing activities

	Wet processing only	Wet and dry processing	Dry processing only
Progressed for further analysis	✓	✓	✗

4.3.3 Scale of processing throughput

An important consideration for the identified problems and opportunities is the scale of an early processor. The larger the scale of processing, the larger the portion of Australia's wool supply that could be insulated from animal disease risks through scouring of wool. The largest installed scours for example are able to process more than 40 million kilograms per annum. A processor of this size would represent a substantial increase on current installed capacity — with Australia exporting around 20 million kg per annum of early stage processed wool in the last 5-years — and account for a significant portion of the total Australian clip (approximately 450 million kilograms in 2022).

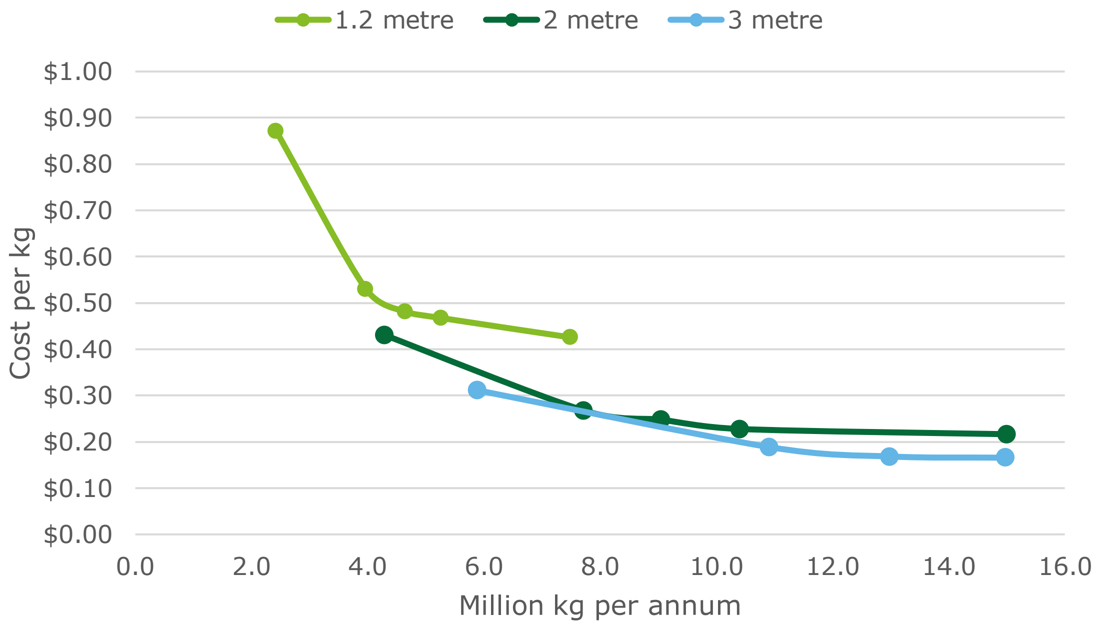
However, it is important to consider the risk mitigation potential alongside the implications size has on cost competitiveness. Consultation with stakeholders advised that processing less than 10 million kg per annum could be considered niche only and is not likely to be commercially viable. In contrast, a processor with installed capacity too large presents a reasonable risk of underutilisation which significantly impacts cost competitiveness.

Early-stage processing incurs substantial fixed costs including mainly plant and machinery expenditure, although labour (a major input) also has limited flexibility in use. Maximising throughput underpins commercial viability by spreading these large, fixed costs over a broader base. The impact of utilisation on total costs is highlighted in Chart 4.3 which describes scouring cost modelling by AEC Group (2021). For three

[42] WOAH, Terrestrial Animal Health Code (2023) *Chapter 8.8: INFECTION WITH FOOT AND MOUTH DISEASE VIRUS* <https://www.woah.org/fileadmin/Home/eng/Health_standards/tahc/current/chapitre_fmd.pdf>

different scour sizes (1.2 metre to 3.0 metre widths), AEC group show that unit costs fall substantially with higher throughput with a 10% increase in throughput resulting in a 5% reduction in unit costs on average.

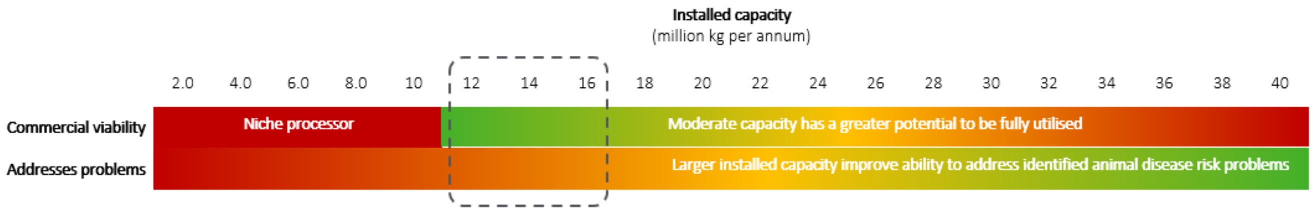
Chart 4.3: Scouring costs by size and annual throughput



Source: AEC Group[43]

In balancing these two considerations it was decided in consultation with industry stakeholders that the optimal scale to progress for further analysis should be a processor of **approximately 15.0 million kilograms per annum**. This size represents a reasonable increase on Australia's existing processing capacity and isn't too small to be niche or being too large to be at regular risk of underutilisation (Figure 4.2).

Figure 4.2 : Summary outcomes for processing scale



4.3.4 Waste processing system

In the past wool scours have been regarded as highly polluting industries mainly because of the high organic load of the effluent. Modern, correctly operated scours are, however, advanced and relatively clean facilities that can minimise processing's impact on the environment and nearby residents. The polluting risk, combined with local water authority's capacity to receive wool scour effluent means that waste is often treated on site. These water treatment systems have advanced considerably over time and are now complex and costly systems. Stylised modelling of a wool scour by Deloitte Access Economics (2022) found that effluent management accounted for around 20% of annual operating costs.

Consideration of waste treatment and disposal in a wool scour is also a critically important consideration because these activities determine how much wool wax can be recovered and sold. Wool wax or lanolin constitutes between 5% (coarse carpet wools) to 25% (fine merino wools) of the weight of freshly shorn wool and is a valuable commodity that, when processed further, can be used in industries such as cosmetics.

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[43] AEC Group, Going Beyond Greasy (n.d.) <https://www.btrc.qld.gov.au/downloads/file/597/going-beyond-greasy>

Maximize Market Research (2022) estimated that the 2021 global lanolin market was worth around $425 million.[44]

A wide range of industrial effluent treatment methods have been employed in wool scouring systems. For scours located in urban areas effluent is discharged into sewers. For some regional areas, sewer discharge is also possible, as is the use of anaerobic ponds and storage lagoons. A summary of 'ponding' treatments is outlined in Halliday (2002)[45] with the process historically prevalent in regional Australia.

No currently operating Australian scours are located in regional or rural areas and so ponding of wool scour effluent no longer occurs in Australia (Geelong is not considered regional for the purpose of this analysis). While technically possible, consultation with industry stakeholders identified that ponding was a challenging system and would require careful consideration of issues such as:

- the need to access to substantial areas of land to environmentally dispose of solid waste and that the land would also likely need to be deficient of key wool scour effluent contaminants, in particular salts like potassium
- a need to be stabilised through either significant chemical treatment or co-location with other organic waste producers (e.g., an abattoir) as wool scouring effluent by itself does not have a sufficiently high calorific value (wool wax itself has a caloric value similar to fuel oil)
- the generation of odour, limiting the potential to be located in close proximity to a town or city
- the likely requirement of substantial environmental regulation, covering both the disposal of solid waste on land and the production of methane from anaerobic ponds.

In consideration of these issues, stakeholder consultation indicated that such a ponding system would likely only be pursued with detailed knowledge of a specific site. As this business case does not consider early-stage processing at this level, ponding systems have not been progressed for further consideration.

The primary method for waste treatment that is progressed in this business case is centred around the use of Sirolan CF, a Chemical Flocculation process. Sirolan CF was specifically developed by the CSIRO in Australia and has been installed in wool scours around the world including China, Europe, and Australia where they remain in use today.

While construction of Sirolan CF systems is dependent on site-specific attributes they can be used in a wide array of locations across both urban and rural areas. Savage (2003)[46] provides a detailed summary of the Sirolan CF process effluent treatment describing it as:

> *"capable of treating the worst polluted effluent from a wool scour to the point where it can either be economically discharged to local trade waste sewer, or directly discharged to river or ocean outfall with minimal environmental impact."*

Table 4.3: Summary outcomes for waste treatment

Progressed for further analysis	Ponding systems	Sirolan CF
In rural areas	✗	✓
In urban areas	Not applicable	✓

[44] Maximize Market Research (2022) Global lanolin Market- Global Industry Analysis and Forecast (2022-2027) - Growth, Trends, COVID-19 Impact, report made by Maximize Market Research Pty. Ltd.
[45] Halliday (2002), Wool scouring, carbonising and effluent treatment <http://182.160.97.198:8080/xmlui/bitstream/handle/123456789/1393/2.%20Woolscouring%20carbonising%20and%20effluenttreatment.pdf?sequence=3>
[46] Savage, M, Integrated Treatment Processes for Primary Wool Scouring Effluent (2003) <https://ir.canterbury.ac.nz/server/api/core/bitstreams/d5f017e4-ff35-4e5a-954d-8944f5de2b9e/content>

4.4 Location analysis

An important consideration for an infrastructure response is where it might be located. This is particularly important for Australia's wool industry which is underpinned by an effective and efficient supply chain that links Australia's regionally located farms with global textile and apparel markets.

An analysis of locations suitable for the infrastructure response is detailed in this section. Several steps were undertaken that included the development of an *initial long list,* before a two-stage screening process that resulted in a final shortlist.

4.4.1 Development of long list of locations

The first step in the location analysis involved identifying a list of locations (a *long list*) of potential options. These were elevated above locations across the rest of Australia because they satisfy two specific criteria identified that are critical to efficient wool processing. These include:

1. proximity to wool aggregation points — to ensure the processing facility can cost effectively access the volume and variety of wool it needs to blend to meet customer needs
2. access to cost-efficient freight networks — to support the minimisation of costs to supply wool for processing

Both items were identified in Phase 1 as critical to processing success in Australia. They are also critical criteria in similar analysis that has previously been performed. This includes for example a Business Victoria report (n.d.) titled Opportunities for Wool Processing in Victoria, which detailed the available infrastructure in across metropolitan and regional Victoria to support the establishment of wool processing.

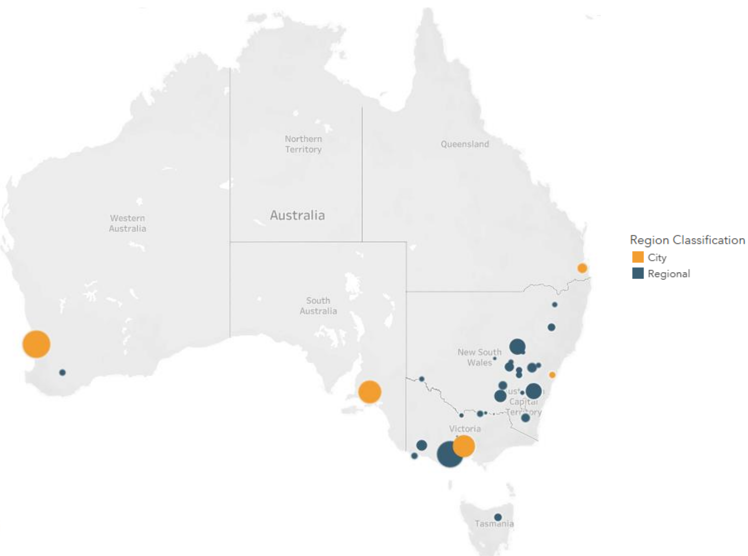
4.4.1.1 Proximity to wool aggregation points

Wool is a natural fibre with significant variation influenced by seasonal conditions, feed intake and geography. For processors to supply downstream customers with consistent and uniform supply, the supply chain needs to blend wool. This requires sufficient access to a diverse wool supply that a single farm or a small group of farms cannot supply. Because of this, an infrastructure response would need to consider location in close proximity to existing aggregation points within the context of the Australian wool supply chain.

A map of Australia's wool aggregation or warehousing network described in Figure 4.3 with the size of markers describing the share of wool stored for auction in 2022-23. Australia's wool warehousing network is strategically positioned across export infrastructure and growing regions.

In most states, the primary aggregation point is in capital cities with metropolitan areas accounting for around half of all warehousing storage. Sydney is however a notable exception with warehousing instead located to the west of the Great Dividing Range. This has been driven in large part by the high capital costs in the city with processing shifting west in recent decades to regional centres within wool growing regions. Similarly, Geelong (while a relatively more urban location) is the major storage location in Victoria supported by close proximity to Melbourne and reduced capital cost pressures.

Figure 4.3: Australian wool aggregation points

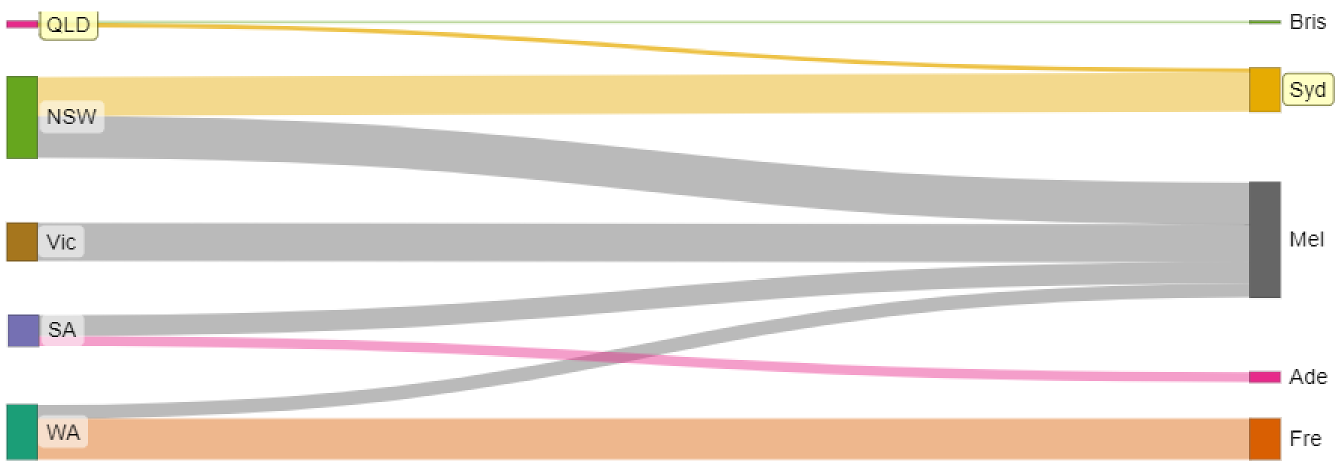


Source: Prological, based on AWEX data

4.4.1.2 Access to existing wool transport corridors

While wool may start in aggregation points, it is a non-perishable transportable commodity that can move across Australia largely unimpeded. Wool is characterised by flows that move the commodity to southeast Australia. This is illustrated in Chart 4.4, which shows Melbourne as the primary export port and sourcing wool from virtually all parts of Australia. These commodity flows predominate in part because of the proximity of the port of Melbourne to major wool growing regions in Victoria and NSW (particularly the Riverina in the state's south). These flows also exist because of backloading opportunities where wool fills otherwise empty consignments returning to Victoria from north or western locations.[47]

Chart 4.4: Stylised illustration of wool commodity flows from state of production to port of export



Source: Deloitte analysis of ABS data[48,49]

Combining the information on aggregation points and transport flows provides a subset of locations where an infrastructure response would have access to a sufficient supply of wool or could obtain it without unsustainable transport costs. This is described in Table 4.4 where an initial long list of 20 locations and regions were identified based on access to wool and transport costs. Locations deemed as suitable for both considerations (bolded and highlighted) are progressed for further options analysis.

Many parts of Australia are assessed as suitable, including regions that currently house wool processors such as Northern Adelaide, the Barwon Region, and Metropolitan Melbourne. Each of the locations have favourable access to large wool aggregation points and could source significant supply along existing transport corridors. Suitable regions also include areas that have historically had processing capacity installed, which include Dubbo, Wagga Wagga, Goulburn, Parkes, Geelong, and Hamilton, among others.

Locations assessed as unsuitable are areas where insufficient wool would be available (for example the Northern Territory) or where transport costs in sourcing wool would be prohibitive (Most of Queensland, Tasmania, and selected areas of northern NSW). Western Australian locations are assessed as not sufficient due to transport constraints despite having a relatively large wool clip from which a processor could draw. In addition to being against prevailing trade flows that would be costly, the state restricts trade from Eastern Australian to manage its own biosecurity risks. Were an infrastructure response developed in Western Australia it would rely only on that state's wool. This means limited opportunities to blend wool and consistently meet consumer orders. It also means shocks to farm production (i.e., from drought) could not be supplemented by supply from other regions.

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[47] The current configuration of wool logistics means the Port of Melbourne exports the largest quantity of greasy wool for wet and dry processing overseas.
[48] ABS, Value of Agricultural Commodities Produced (2023), <https://www.abs.gov.au/statistics/industry/agriculture/value-agricultural-commodities-produced-australia/latest-release>
[49] ABS, International Merchandise Trade (2023)

Table 4.4: Long list of locations

State	Example location	Access to wool aggregation points	Access to transport corridor	Overall Suitability
NT	Darwin	Not suitable	Not suitable	Not suitable
NSW	**Central Western NSW**	**Suitable**	**Suitable**	**Suitable**
NSW	**Southern Tablelands**	**Suitable**	**Suitable**	**Suitable**
NSW	**Riverina**	**Suitable**	**Suitable**	**Suitable**
NSW	Greater Sydney	Not suitable	**Suitable**	Not suitable
NSW	Northern Tablelands	**Suitable**	Not suitable	Not suitable
QLD	Darling Downs Southwest	Not suitable	Not suitable	Not suitable
QLD	Southeast QLD	**Suitable**	Not suitable	Not suitable
QLD	Central QLD	Not suitable	Not suitable	Not suitable
QLD	Darling Downs	Not suitable	Not suitable	Not suitable
QLD	Central QLD	Not suitable	Not suitable	Not suitable
SA	**Metro Adelaide**	**Suitable**	**Suitable**	**Suitable**
SA/Vic	**Green Triangle**	**Suitable**	**Suitable**	**Suitable**
TAS	Northern Tasmania	**Suitable**	Not suitable	Not suitable
Vic	Central Highlands	Not suitable	**Suitable**	Not suitable
Vic	**Metro Melbourne**	**Suitable**	**Suitable**	**Suitable**
Vic	**Barwon**	**Suitable**	**Suitable**	**Suitable**
Vic	**Goldfields region**	**Suitable**	**Suitable**	**Suitable**
WA	**Metro Perth**	**Suitable**	**Suitable**	**Suitable**
WA	Southern WA	**Suitable**	Not suitable	Not suitable

4.4.2 Shortlist of locations

The next stage in the options development process involved refining the long list of locations (section 4.4.1) into a shortlist for subsequent further analysis. This shortlisting process was performed in two stages. First locations were compared and contrasted using multi-criteria analysis (MCA) before a risk assessment was undertaken using the same criteria. The remainder of this section first describes the assessment criteria, followed by the outcomes of the MCA and the risk assessment.

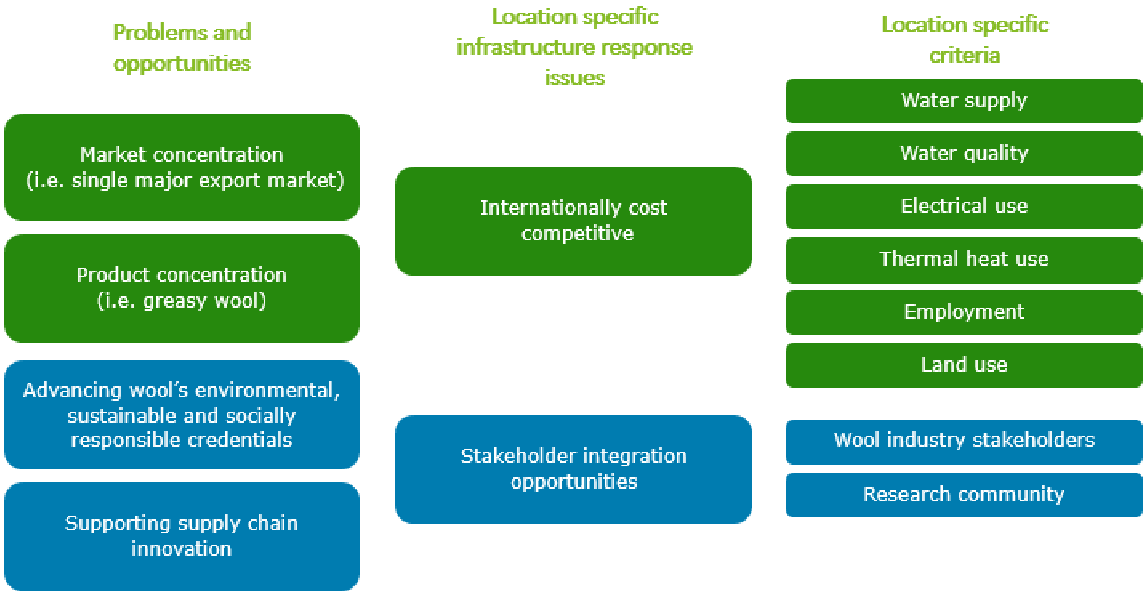
4.4.2.1 Criteria for shortlisting

The selected criteria to assess locations were developed by considering how choice of location best supports addressing the identified risks and opportunities. Figure 4.4 illustrates the logic linking MCA and risk assessment criteria with the identified problems and opportunities.

For the identified risks (market and product concentration), location choice principally affects the potential for an infrastructure response to be internationally cost competitive, by influencing prices for key inputs. This includes operational costs such as utilities and employment, as well as capital costs. Water quality was also included as a key criterion that influences cost competitiveness and the potential to address the identified problems. This is because the amount of dissolved calcium and magnesium in the water used (i.e. its hardness) during scouring affects machinery maintenance costs and the potential to effectively wash wool.

For the identified opportunities the location of an infrastructure response provides an opportunity to integrate with other key stakeholders. This includes engaging with wool industry supply chain participants to support advancing wool's environmental, sustainable, and socially responsible credentials. It also includes engaging with the research community to support ongoing innovation along the supply chain.

Figure 4.4: Location specific criteria



4.4.2.2 Multi-criteria analysis

The multi criteria analysis is performed by scoring locations against each criterion. Scores range from low (zero) to high (4), with a medium value (2) also possible. Each criterion has individual thresholds for achieving these scores reflecting the specific data sources used to inform the individual criteria. The scoring thresholds for each criterion is outlined in Table 4.5 with further detail provided in Appendix A.

Several of the criterion are informed by publicly available datasets with the Aqueduct Water Risk Atlas[50] for example informing the availability of water supply criteria by mapping and analysing areas across Australia against current and future water risks. Similarly, the Australian Energy Market Operator[51,52] was used to inform location scores for electricity and thermal energy based on the potential to connect to distributional

[50] Aqueduct, Water Risk Atlas (n.d.) <https://www.wri.org/applications/aqueduct/water-risk-atlas>
[51] AEMO, NEM regional boundaries map (n.d.) https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/maps/nem-regional-boundaries-map-web.pdf?la=en
[52] AEMO, About the gas bulletin board (n.d.) https://www.aemo.com.au/energy-systems/gas/gas-bulletin-board-gbb/about-the-gas-bulletin-board-gbb

infrastructure. Other energy considerations were not included such as site connection costs – because it requires detailed site specific information - and electricity prices – where are assessed in the financial analysis.

Several other criteria thresholds were constructed by combining information from a variety of sources or several indicators from a single source. Scores for water quality for example were informed by location specific reports on water hardness, generally published by individual local water authorities. While the Local labour supply criteria was informed by creating a bespoke index that balanced labour supply (i.e. unemployment) and worker demand (using job advertisements). A bespoke index was also constructed to assess land availability in each location, combining data that describes:

- market activity – The average volume of transactions withing the location.
- land costs – The range of land value rates on a $/sqm basis derived from a sample of sales transactions within the location analyses on an improved basis.
- adaptive reuse opportunity – Brownfield site opportunities that can be readily converted to the required use (whether vacant or with existing improvements) without the need for a change in land use or other onerous planning requirements.
- strategic planning framework – Greenfield site opportunities that are being delivered or will be delivered through strategic planning frameworks.

Table 4.5: MCA criteria and score thresholds

Criteria	Source	Low threshold (0/4)	Medium threshold (2/4)	High threshold (4/4)
Water supply	Aqueduct Water Risk Atlas	Location assessed as extremely high overall water risk	Medium-high overall water risk	Location assessed as low overall water risk
Water quality	Local water authorities	Water hardness is more than 180 ppm	60 to 120 ppm	Water hardness is less than 17.1 ppm
Electricity	AEMO	No connection in region is available	n.a	Connection in region is available
Process heat	AEMO	No connection in region is available	n.a	Connection in region is available
Local labour	Unemployment to job add ratio	Location has 0 unemployment or 0 job adds	Ratio score between 1.5 to 2.6	Ratio score of more than 3.2
Land availability	Land desirability index	Score of 11 (20%) or less	Score of between 22 and 33 (41% to 60%)	Score of 44 (81%) or greater
Supply chain participant	Author research	No processing facilities in region	n.a.	One or more processing facilities region
Research institutions	Author research	No research institutions in the region	One or more research institutions (without specific technical capability) are in region	One or more research institutions are located within the same region with technical capabilities

Note: n.a. refers to not applicable.

A summary of the scoring outcomes of the location MCA is provided in Table 4.6.

Table 4.6: Location Multi-criteria analysis

Criteria	Central Western NSW	Southern Tablelands	Riverina	Metro SA	Green Triangle	Metro Vic.	Barwon region	Goldfields region	Metro WA
Ensure relative availability of water	●	◑	◕	◑	●	◕	◕	◕	●
Maximise existing quality of water	◔	◔	◕	○	◑	◕	◕	◑	◑
Minimise electricity usage costs	●	●	●	●	●	●	●	●	●
Minimise process heat costs	●	●	●	●	●	●	●	●	●
Maximise employment of	●	●	◑	◑	●	◔	◑	◕	◔
Minimise industrial land costs	◕	●	◑	◑	◔	◑	◑	◑	●
Maximise ability to integrate with	○	○	○	●	○	●	●	○	○
Maximise ability to partner with	◕	◕	●	●	◕	●	◕	◕	●
Score	**23**	**22**	**22**	**22**	**22**	**25**	**25**	**21**	**23**
Relative score	**72%**	**69%**	**69%**	**69%**	**69%**	**78%**	**78%**	**66%**	**72%**
Ranking	**3**	**6**	**6**	**6**	**6**	**1**	**1**	**9**	**3**

4.4.2.3 Risk assessment

Following the MCA, a risk assessment for each location was undertaken. The risk assessment involved assessing the potential consequence (from C1: low to C5: extreme) of risks for each criterion, and then assigning location specific likelihoods (from L1: rare to L5: Almost certain) to develop a combined risk rating. The framework for this rating is described in Figure 4.5.

Figure 4.5: Risk rating framework

				Consequence				
				C1	C2	C3	C4	C5
Likelihood	Almost Certain	> 90%	L5	Medium	Medium	High	Extreme	Extreme
	Likely	50-	L4	Low	Medium	High	High	Extreme
	Possible	11-	L3	Low	Medium	Medium	High	High
	Unlikely	1-10%	L2	Low	Low	Medium	Medium	High
	Rare	< 1%	L1	Low	Low	Low	Medium	Medium

A summary of consequence ratings for each of the identified risks are presented in Table 4.7 below. The most severe consequences are assessed as arising from an inability to secure wool for processing (#1). Were this to materialise, a processor would not be able to appropriately blend to meet individual buyer specifications resulting in reduced demand, lower throughput, and significantly reduced profitability. The availability of labour (4) was assessed as a relatively lower consequence risk for processing (C2), mainly due to labour being mobile and can migrate to regions where skills are in demand.

The assessed likelihood of criterion risks for each location is outlined in Table 4.8 below. On average across the criteria, risk likelihoods are relatively consistent for each location with only one or two locations seen as higher likelihood for a specific criterion. This is demonstrated for example in the criteria for Water availability (2) and quality (3) where NSW's Southern Tablelands region and Metropolitan Adelaide are assessed as having the highest risk likelihood (L3), while most other regions were assess as having likelihoods of Unlikely (L2) or Rare (L1).

The primary criterion where location likelihood differs materially is Criterion 1: being able to secure adequate wool to supply buyers. For this criterion, most locations are assessed as low likelihood (L1) because they face no barriers in securing wool and can access nearby wool aggregation warehouses with relatively favourable transport (see section 4.4.1). In contrast, Western Australia is assessed as high likelihood (L5) because the state restricts the transport of wool from other states due to biosecurity concerns meaning processors can only supply buyers from the WA clip. Were a drought to occur or adverse seasonal conditions that affects the quality or quantity of the wool in the state, processors would have few options in blending to meet buyer specifications.

In comparing regions, Central Western NSW and the Southern Tablelands have some of the highest risk likelihoods due to their water quality and lack of existing processing infrastructure. While metropolitan Melbourne and the Barwon region present the lowest risk likelihoods. This is due to favourable labour supply in these regions, as well as water availability and quality, as well as access to wool supply.

Table 4.7: Summary consequence ratings for identified criteria risks

#	Risk	Consequence rating	Rational
1	Seasonal conditions affect the quality or the distribution of the wool clip's specifications	C5	Without security of wool supply processors will not be able to meet buyer specifications resulting in extreme consequences
2	Water availability becomes scarce due to drought and usage restrictions	C4	Water is a major input to production and higher prices would impact cost competitiveness.
3	Seasonal conditions affect the quality of water supplied in the location	C3	Water quality can be managed but is important as it affects production costs and processing output quality.
4	Insufficient local population and skills to meet labour demands	C2	Labour is mobile and can move to locations that require skilled employees with technical processing skills.
5	Collaboration with near-by processing facilities is not established	C1	While generally cooperative, collective industry R&D is not undertaken
6	Supply chain or input disruptions create cost challenges for capital works phases	C4	Capital is a significant component of total costs for a processor and delays can materially affect investment returns.
7	Trunk connection issues (gas and/or electricity) arise or supply disruptions occur	C2	Utilities disruptions, while costly are expected to be short term only, limiting their consequence for a location.
8	Policy environment adjusts impacting facility's ability to dispose of effluent	C4	Treatment of scouring waste is a costly and complex issue. Regulatory changes can materially impact processor's operations.
9	The shift towards net zero causes increased GHG emissions restrictions on the industry	C2	Clean energy options exist for the processing industry to use limiting the consequence of policy action or supply chain demands.

4.4.2.3.2 Risk assessment outcomes

Combining these likelihood assessments with the consequences outlined in Table 4.7 yields criteria and location risk assessments. The outcomes of the risk assessment are detailed in Table 4.9. In general, most locations have relatively similar risk ratings reflecting comparable risk likelihoods for most criteria. Most regions score a 'high' rating in at least one criterion but are assessed as 'medium' or 'low' for all others.

Overall, the metropolitan Melbourne region provides the lowest risk across the assessed locations, registering a 'low' risk rating in four of nine locations. Of the remaining Criteria, metropolitan Melbourne scores mostly 'medium' except Criteria 8 (Policy environment adjusts impacting facility's ability to dispose of effluent) where the location is assessed as 'high'. Metropolitan locations are assessed as having a higher likelihood of being affected by this risk as they face higher waste disposal charges and have fewer alternatives if preferred disposal methods are disrupted.

Metropolitan Perth present as the highest risk location, scoring 'low' in only two criteria. The location scored mostly 'medium' risks and also registered two 'high' risk ratings. The location's high scores are for Criteria 8 (like Metropolitan Perth) and for Criteria 6 (Supply chain or input disruptions create cost challenges for capital works phases) with the location having experienced significant disruption to its capital works sector in recent years. Most significantly though, Metropolitan Perth has an extreme risk rating for Criteria 1 (security of wool supply).

Table 4.8: Summary consequence ratings for identified criteria risks

No.	Criteria risk	Central Western NSW	Southern Tablelands	Riverina	Adelaide	Green Triangle	Melbourne	Barwon region	Goldfields region	Perth
1	The processing facility does not receive an adequate variety of wool fibres to produce a desired end product	L1	L1	L1	L1	L1	L1	L1	L1	L5
2	Water availability becomes scarce due to drought and usage restrictions	L1	L3	L2	L3	L1	L2	L2	L1	L1
3	Water quality is not suitable due to water supply event (e.g., drought)	L1	L3	L2	L3	L1	L2	L2	L1	L1
4	Insufficient local population and skills to meet labour demands	L2	L1	L2	L2	L1	L2	L3	L2	L1
5	Collaboration with near-by processing facilities is not established	L5	L5	L5	L2	L5	L2	L2	L5	L5
6	Supply chain or input disruptions create cost challenges for capital works phases	L3	L3	L3	L2	L3	L2	L2	L3	L3
7	Trunk connection issues (gas and/or electricity) arise or supply disruptions occur	L2	L2	L2	L2	L2	L2	L2	L2	L3
8	Policy environment adjusts impacting facility's ability to dispose of effluent	L1	L1	L1	L3	L1	L3	L3	L1	L3
9	The shift towards net zero causes restricts industry use of carbon-intensive systems restrictions on the industry	L4	L4	L4	L4	L4	L4	L4	L4	L4

Table 4.9: Criteria and location risk ratings

No.	Criteria risk	Central Western NSW	Southern Tablelands	Riverina	Adelaide	Green Triangle	Melbourne	Barwon region	Goldfields region	Perth
1	The processing facility does not receive an adequate variety of wool fibres to produce a desired end product	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Extreme
2	Water availability becomes scarce due to drought and usage restrictions	Medium	High	Medium	High	Medium	Medium	Medium	Medium	Medium
3	Water quality is not suitable due to water supply event (e.g., drought)	Low	Low	Low	Low	Low	Low	Low	Low	Low
4	Insufficient local population and skills to meet labour demands	Low	Low	Low	Low	Low	Low	Medium	Low	Low
5	Collaboration with near-by processing facilities is not established	Medium	Medium	Medium	Low	Medium	Low	Low	Medium	Medium
6	Supply chain or input disruptions create cost challenges for capital works phases	High	High	High	Medium	High	Medium	Medium	High	High
7	Trunk connection issues (gas and/or electricity) arise or supply disruptions occur	Low	Low	Low	Low	Low	Low	Low	Low	Medium
8	Policy environment adjusts impacting facility's ability to dispose of effluent	Medium	Medium	Medium	High	Medium	High	High	Medium	High
9	The shift towards net zero causes restricts industry use of carbon-intensive systems restrictions on the industry	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium

4.5 Final shortlist of options

As outlined earlier, the final shortlist of options is determined by combining the outcomes of the MCA and risk assessment. A simple sum that combines the ranking of the two assessments is detailed in Table 4.10. Metropolitan Melbourne and the Barwon region score the highest performing among the best in both the MCA and the risk assessment. For this reason, these two locations are progressed further for analysis of value for money.

Given the relative similarity in these two locations the locations have been aggregated into a larger **metropolitan Victoria region** to be progressed. Behind metropolitan Victoria, other regions score comparatively evenly and because two of these locations are also in a broader identifiable area in **regional NSW**, (Central Western NSW and the Riverina) they are aggregated and progressed for the value for money assessment. The Southern Tablelands is also included in this region for simplicity but does not score as well as the other NSW locations.

The remaining locations progressed to the value for money assessment are **Metropolitan Adelaide** and the **Green triangle**. Both of these regions achieve average or moderate scores across the MCA and risk assessment in contrast to Victoria's Goldfields region or Perth which are not progressed.

It is important to note that locations that that do not progress for further analysis in this Business Case could present as worthwhile areas to undertake early-stage processing in Australia. However, the selected four locations that are progressed are assessed as having the best chance of addressing the problems and opportunities.

Table 4.10: Criteria and location risk ratings

Location	MCA rank	Risk rank	Sum of ranks	Rank of ranks	Aggregated region
Central Western NSW	3	4	7	3	**Regional NSW**
Southern Tablelands	6	8	14	9	
Riverina	6	4	10	4	
Adelaide	6	4	10	4	**Metropolitan Adelaide**
Green Triangle	6	4	10	4	**Green Triangle**
Melbourne	1	1	2	1	**Metropolitan Victoria**
Barwon	1	4	5	2	
Goldfields	9	4	13	8	Not progressed
Perth	3	8	11	7	Not progressed

5 Value for Money Assessment

The financial assessment found wet processing in Metropolitan Victoria as the option most likely to be financially viable. The assessment also indicated that the various options considered were broadly comparable and that site specific considerations could provide substantial opportunity for establishing wool processing capacity in Australia.

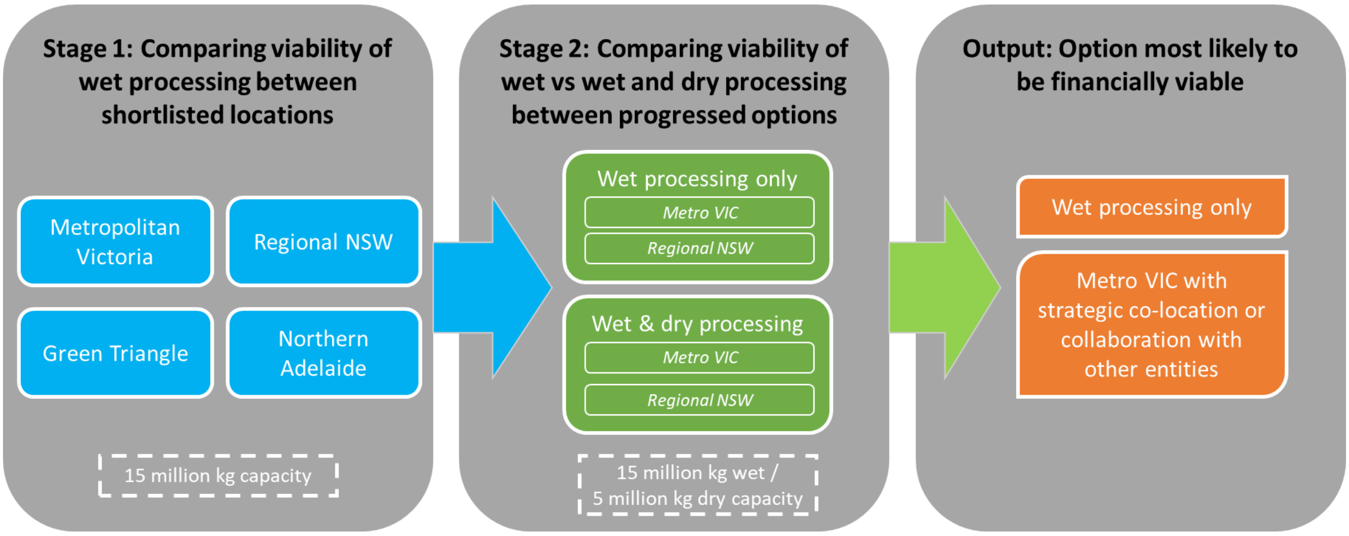
5.1 Objectives

A value for money assessment (or 'financial appraisal') is used to evaluate the financial viability of a proposed project. Financial analysis is a core component of Infrastructure Australia Business Case Guidelines, and an important element in options comparison.

This chapter outlines a financial assessment of early-stage wool processing in Australia. The approach largely follows the Infrastructure Australia Business Case Guidelines[53] but focuses mainly on the commercial aspects of wool processing, with social costs and benefits (as per a complete Cost Benefit Analysis) not considered in this analysis. This was in part to communicate the financial performance of wool processing for both government and industry audiences, but also to identify critical viability factors which might support expanding wool processing capacity in Australia in the future.

The assessment was undertaken in two stages as illustrated in Figure 5.1, and compares the options shortlisted in Chapter 4. First, the financial performance of shortlisted locations was compared, with selected locations progressing to a second stage that considered differing processing activities (i.e. wet processing only or wet and dry processing combined).

Figure 5.1: Outline of modelling stages



Source: Deloitte Access Economics

The structure of the remainder of Chapter 5 is as follows. Section 5.2.1 defines the 'base case' used in the financial analysis framework. Section 5.2.2 details the two modelling stages, and the in-scope and out-of-

[53] Infrastructure Australia guidelines recommend that a full cost-benefit analysis be undertaken to compare the economic as well social and environmental costs and benefits between the shortlisted options.

scope items. Section 5.3 contains a summary of the financial model results across shortlisted locations and processing capabilities, while section 0 discusses non-financial considerations affecting investment decisions.

5.2 Methodology

A financial model of early-stage wool processing was constructed to consider cashflows, including capital and operating costs and revenues, reported over time and in net present value (NPV) terms between shortlisted locations and processing capability. The results generated by the model are complemented with qualitative analysis of non-financial risks to project cashflows, as well as financial interdependencies with other infrastructure and policies.

5.2.1 Defining the base case

A financial appraisal only considers costs and revenues attributable to the project. The net present values of a given investment proposal (the 'project case') are compared to those that would have otherwise occurred in the absence of the investment (the 'base case'). In this business case, the base case is assumed to be zero, given the small existing footprint of wool processing in Australia and improbability that processing capacity will expand without Government intervention. The project options are hence compared in isolation, rather than relative to a base case.

5.2.2 Financial modelling stages and assumptions

The financial modelling was conducted in two successive stages.

1. the **first stage** compared the financial viability of wet processing only between the four shortlisted locations: Regional NSW, Metropolitan Victoria, northern Adelaide, and the Green Triangle. The outcome of this stage was the progression of Metropolitan Victoria and regional NSW to the second stage
2. the **second stage** assessed the viability of principally wet processing with partial dry processing capacity between Metropolitan Victoria and regional NSW. Wet processing only in Metropolitan Victoria was deemed the most financially viable option, and therefore 'elevated' amongst the shortlisted options.

Consistent with the findings of Chapter 4, all options are modelled with a scouring capacity of 15 million kilograms per annum with waste assumed to be treated using a Sirolan CF system. It is also assumed that processing is performed on a commission basis, mainly because the wool scours that currently remain in operation in Australia operate in this way. This processing model is a lower cost operation than the main alternative: a merchant wool processor – who obtains and processes wool for the use of their own supply chain – mainly due to the large storage needs of a merchant operation.

For stage 1, wet processing only was considered as this activity contributes to disease risk mitigation, a core project objective (see section 4.3.2). Stage 2 is constructed to consider a processing facility that undertook both wet and dry processing. Through discussions with stakeholders, it was determined that the dry processing capacity should account for only *part* of the facility's assumed wet processing output.[54]

5.2.3 Scope of the financial analysis

Given the early phase of the project, there are essential location-specific details which are not yet available. The financial analysis was therefore designed to approximate the major capital and operating expenditure items incurred in constructing and operating a wool processing plant, and include some regional variation. The objective of the financial modelling was to assess the relative performance between location and capability options (illustrated in Figure 5.1), and indicate which scenario is most likely to be financially viable.

The modelling was not designed to indicate the specific amount of capital required to establish a wool processing plant. Additionally, the model *by itself* does not indicate whether a particular combination of location and capability will be financially viable.

All cost and revenue figures are best estimates and were not obtained from an actual wool processing plant in Australia or overseas. Expenditure items (particularly capital expenditure) are not site-specific; that is, they are not attached to a particular site in the shortlisted locations. The expenditure figures are instead general estimates, or in some cases, regional averages.

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[54] Industry stakeholders advised during consultation, that market development for dry processing output (i.e. wool tops) could be more challenging given current market conditions.

5.2.3.1 Key assumptions

The capital expenditure items included in the analysis (for both wet and dry processing) are the purchase of land; construction of the facility; purchase of wet processing machinery; and the construction of an onsite effluent treatment plant. The operating expenditure items include labour; energy costs (electricity and gas); water; consumables; maintenance; and transport. Methods used to obtain each cost line item and data sources are detailed in Appendix B.

Wool transport was also included as a cost item to account for cost differences the supply chain would incur were processing established in various locations. Transport costs are generally borne by the entity commissioning the wool processing, rather than the processor. For this reason two sets of headline results are presented with and without transport costs.

Cost items included in the financial model by category are listed in Figure 5.2. Where possible estimates were obtained via industry consultation or published sources. Several items included in the modelling were collected from the primary sources. As the analysis is undertaken at a regional level, many of the inputs parameters and assumptions are aggregates of more specific areas within those regions. This includes for example:

- **Land purchase prices** — average of recent industrial land sales in assessed regions
- **Water usage charges** — averages of local water authority or Council charges in relevant regions
- **Trade waste discharge costs** — regional averages of local water authority or Council charges
- **Energy charges** — averages of state level industrial rates obtained by combining wholesale prices and average retailer margins.

Figure 5.2: Capital and operating expenditure cost items included in the financial model

Costs	
Capital expenditure (Capex)	**Operating expenditure (Opex)**
Land acquisition • Land purchase cost **Construction** • Greasy wool warehouse • Scour hall • Processed wool warehousing • Office • Pressing/packing area • Carding area • Combing hall **Machinery** • Scour • Wool press • Bin blending unit • Forklift • Cards • Combs • Chain gills **Effluent treatment** • On-site trade waste sewer treatment via Sirolan CF system	**Effluent treatment** • On-site effluent treatment • Council trade waste discharge costs **Utilities** • Water usage – scouring • Gas usage - scouring • Electricity usage – scouring, carding, combing, gilling **Labour** • Mid-management: production, maintenance, quality assurance, logistics, administration managers and assistants • Skilled: Machine operators, maintenance staff, lab staff, warehouse coordinator • Unskilled: Labourers, forklift drivers **Consumables** • Wet processing: detergent, soda • Dry processing: lubricant, antistatic • Tops and noils baling and packaging **Maintenance** • Machinery maintenance **Transport** • Per-kg wool scoured transport costs from point of aggregation to port

Three revenue items were included in the financial model:

- a scoured wool tariff
- wool wax (lanolin) revenue under wet processing, and
- a top making tariff (including noil) under dry processing.

The scoured wool and top making tariffs have a high degree of uncertainty attached. Industry advised that prevailing tariff rates are set according to the type of wool processed, the business operation, markets serviced and can include service additions such as freight to port. In the model, scouring and top making tariffs were estimated by taking the midpoint of a range of corresponding tariffs reported by industry sources, and domestic and international wool processors (converted to Australian dollar terms). Wool wax prices were assessed as being fundamentally driven by global energy prices and were informed by data collected from the US Federal Reserve Economic Database.

5.2.3.2 Model limitations

The model used to financially assess wool processing in Stages 1 and 2 has a range of limitations that should be acknowledged when interpreting the results. It does not contain site-specific capital costs, operating costs or revenue streams. The main limitations are detailed in Appendix B and include:

- **Utilities connection costs** (including civil, electricity, water and gas infrastructure) were not included as estimates require detailed knowledge of site specifics (including for example distance to distributional networks).
- **Solid waste disposal/transport** was not included due to uncertainty around whether solid waste would be disposed of for a fee, or sold to a third party and therefore included as a revenue stream.
- **Earthworks and land remediation** are assumed to not be required.
  Licenses, permits and other office overheads to operate a processing facility were not included since information is not available at this early stage of the project.

5.3 Financial Appraisal Results

This section details the results of the two-stage financial appraisal. A summary of the outcomes is initially provided, before more detailed descriptions of stages 1 and 2.

The financial modelling demonstrated that financial returns are positive but low and broadly similar between options. With wet processing only, NPVs range from effectively $0 in regional NSW to $14.1 million in the Green Triangle. It is also demonstrated that dry processing capability does not materially improve financial performance, mainly due to the cost of additional capital equipment (and to a lesser extent land and labour) eating into increased earnings. A summary of results is provided in Table 5.1 below.

Table 5.1: Summary of financial results across stage 1 and 2, FY24-54

Item	Regional NSW	Metropolitan Vic.	Metropolitan SA	Green Triangle
Stage 1: wet processing only (excluding transport)				
Net Present Value	0.0	12.8	3.0	14.1
Internal rate of return	0%	0%	0%	0%
Stage 2: wet and dry processing (excluding transport)				
Net Present Value	**8.8**	**21.8**	Not assessed	
Internal rate of return	**0%**	**0%**		

Source: Deloitte Access Economics
Notes: All values are estimated off escalated prices, dollar values in present value terms, discounted at 7%

It is important to highlight that the location and capability combinations specified in the two scenarios are not the only possible combinations of options that could be financially viable. The long list of options (Table 4.4) contains locations which could be financially viable, depending largely on site-specific costs as well as opportunities for strategic co-location with other industrial facilities to eliminate or reduce the major cost items, discussed further in 0. The financial appraisal instead provides certainty that a future project can deliver (at minimum) on what is proposed in the business case. The final decision on a preferred option is made by the successful tender of a competitive tender process.

5.3.2 Stage 1: Comparison of locations

Summary of Stage 1 Outcomes

- Across all locations **financial returns are positive, low and comparable.**
- **Land, energy, and effluent treatment** are the primary cost levers.
- **Metropolitan Melbourne** and **Regional NSW** were progressed to Stage 2 modelling.

Measures of profitability across all locations and over the 30-year facility horizon are marginally positive to negative. Net present values excluding transport costs range from $14.1 million in the Green Triangle to $0 million in Regional NSW. [55] When factoring in transport costs, NPVs are lower in all locations, ranging from negative $29.5 million in Regional NSW to $0.1 million in Metropolitan Victoria.[56] Further, the internal rates of return (IRR) are zero across all locations,[57] indicating a rate of return of essentially zero over the 30-year facility lifespan assuming a discount rate of 7% p.a. The inclusion of transport costs does not materially affect the IRRs.

In terms of capital costs, the major lever is land purchase costs. Industrial land in the Green Triangle and regional NSW is significantly cheaper than metropolitan Victoria (particularly sites in the industrial north-west) and northern Adelaide. Construction costs also vary across locations, but to a lesser extent than land. Construction costs are slightly higher in regional areas due to additional freight and transport costs, but are not substantial enough to offset the difference in land costs.

The major operating cost levers are energy use,[58] followed by effluent treatment (both onsite and offsite). Energy costs are substantially higher in regional NSW than metropolitan Victoria, primarily due to relatively higher gas costs in NSW. The industrial electricity rate is also higher in NSW than Victoria. Energy prices in the model are inflated due to the global energy supply shortage in 2022, the acute effects of which have since eased but which are still affecting the prices used in this analysis.

Furthermore, transport costs are materially lower for Metro Victoria and the Green Triangle than regional NSW. According to Prological analysis, Melbourne's proximity to major wool producing regions and wool stores in Victoria and NSW reduces transportation costs. Melbourne is also a back-load destination from Brisbane and Adelaide, which makes inbound freight to Melbourne cost effective compared to moving wool in the opposite direction towards Adelaide or Sydney.

Overall, the financial analysis found similar headline financial results between the four shortlisted locations, with no clear standouts. Workshops with stakeholders were held to decide on the locations progressed to stage 2 analysis. The locations that were 'elevated' for further analysis were Metropolitan Victoria and Regional NSW. The Green Triangle was struck out due to workforce concerns, particularly the ability to source sufficient staff with necessary technical skills. North Adelaide was also not progressed, principally due to the high cost of sourcing wool from aggregation points in the southeast, and transporting processed wool back to the Port of Melbourne.

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[55] Profit earned over the lifetime of the project, discounted at a compounding rate of 7.5% p.a.
[56] The impact of freight costs on profitability is overstated, since commission processors generally only pay for freight from processing facility to port and recover it via their scouring tariff.
[57] The internal rate of return represents the discount rate at which the net present value of the project's cash flow becomes zero. In other words, the IRR is the rate of return that makes the present value of the project's inflows equal to the present value of its outflows.
[58] Excludes connection costs as outlined in section 5.2.3.2

Table 5.2: Wet Processing Financial Appraisal Results, FY24-54

Item	Regional	Metropolitan	Metropolitan	Green
Capital costs				
Land purchase cost	0.6	3.9	4.9	0.3
Effluent pre-treatment	0.8	0.8	0.8	0.8
Construction	23.7	21.6	21.7	23.7
Machinery	7.4	7.4	7.4	7.4
Total capital costs	**32.5**	**33.8**	**34.8**	**32.3**
Operating costs				
Effluent treatment (onsite and offsite)	14.1	15.9	11.8	13.6
Energy	47.7	32.0	47.8	39.9
Water	2.9	3.9	4.3	3.9
Labour	80.9	79.8	76.4	74.4
Consumables	6.9	6.9	6.9	6.9
Baling	0.1	0.1	0.1	0.1
Maintenance	4.8	4.8	4.8	4.8
Total operating costs	**157.4**	**143.4**	**152.2**	**143.6**
Total costs	**189.9**	**177.2**	**186.9**	**175.9**
Transport cost	29.5	12.7	31.4	17.7
Revenue				
Scouring revenue	119.6	119.6	119.6	119.6
Wool wax revenue	70.4	70.4	70.4	70.4
Total revenue	**189.9**	**189.9**	**189.9**	**189.9**
Net present value				
- **Inc. transport**	**(30.1)**	**(0.5)**	**(28.4)**	**(3.7)**
- **Ex. transport**	**0.0**	**12.8**	**3.0**	**14.1**
Internal rate of return				
- **Inc. transport**	**(0.1%)**	**0.1%**	**(0.0%)**	**0.1%**
- **Ex. transport**	**0.1%**	**0.1%**	**0.1%**	**0.1%**

Source: Deloitte Access Economics
Notes: All values are estimated on escalated prices, dollar values are present value terms, discounted at 7%

5.3.3 Stage 2: Comparison of Wet only and Wet and Dry processing

Summary of Stage 2 Outcomes

- **Wet processing only** best supports the overarching objectives by delivering animal disease risk mitigation at a substantially lower cost than wet and dry processing
- Adding partial dry processing capacity results in an **almost doubling of required capital expenditure**, primarily due to additional machinery and construction costs.
- Inclusion of dry processing **increases total discounted revenue by $63 million** relative to a wet processing only facility
- However higher capital costs offset the revenue increase resulting in Wet and Dry processing **not materially improving profitability** over a 30-year horizon.

Table 5.3 presents the financial results of a 15 million kilogram per year wet processing plant, co-located with 5 million kilograms per year of dry processing capacity in both regional NSW and metropolitan Victoria.

The results show that all NPVs are positive, with metropolitan Victoria seeing positive NPVs when including or excluding transport costs. The relatively more positive result for Metropolitan Victoria mainly reflects much lower energy costs which are nearly 50% lower than that for regional NSW.

In comparison Regional NSW registers a positive NPV without transport costs, but the additional distances wool is required to travel results in a lower NPV overall when included. While regional NSW registers lower costs in general across most operating inputs, its relatively higher energy costs have a significant effect on the results.

Despite top making adding around 50% of the value of scouring revenue, the headline financial results are only slightly improved from that reported in stage 1. A key driver is the cost of machinery required for dry processing, which adds $16.5 million (PV) in capital costs for both regional NSW and Metropolitan Victoria. The extra floor space required for a carding and combing hall and wool store also adds to land purchasing costs, further disadvantaging Metropolitan Victoria. Labour costs also increase materially from the wet processing only scenario for both locations. Overall, the additional revenue from top making only marginally exceeds the extra capital and operating expenses incurred in establishing dry processing.

Inclusion of dry processing does provide a number of commercial advantages[59] but for the supply chain more broadly, it does not improve (above wet processing only) risk mitigation from animal disease events as no additional scouring is delivered. As such, wet and dry processing provides the same level of potential risk mitigation as wet processing only, but at a significantly higher capital cost – for this reason the wet only scenario is identified as the preferred option for this business case.

[59] Industry consultation advised that inclusion of dry processing enables greater control along the supply chain and allows for ease of sale and market entry as there are currently relatively more buyers of wool top than scoured wool

Table 5.3: Wet and Dry Processing Financial Appraisal Results, FY24-54

Item	Regional NSW	Metropolitan Vic.
Capital costs		
Land purchase cost	0.8	5.7
Effluent pre-treatment	0.8	0.8
Construction	35.9	32.9
Machinery	23.9	23.9
Total capital costs	**61.5**	**63.3**
Operating costs		
Effluent treatment (onsite and offsite)	14.1	15.9
Energy	51.4	34.8
Water	2.9	3.9
Labour	93.2	92.2
Consumables	10.1	10.1
Baling	2.4	2.4
Maintenance	9.0	9.0
Total operating costs	**183.2**	**168.3**
Total costs	**244.7**	**242.5**
Transport cost	30.1	13.3
Revenue		
Scouring revenue	119.6	119.6
Wool wax revenue	70.4	70.4
Top making revenue	63.6	63.6
Total revenue	**253.5**	**253.5**
Net present value		
- **Inc. transport**	**(21.3)**	**8.6**
- **Ex. transport**	**8.8**	**21.8**
Internal rate of return		
- **Inc. transport**	**0.1%**	**0.1%**
- **Ex. transport**	**0.1%**	**0.1%**

Source: Deloitte Access Economics
Notes: All values are estimated on escalated prices, dollar values are present value terms, discounted at 7%

5.4 Sensitivity analysis

A sensitivity analysis is a key component of any modelling to determine how different assumptions and parameters affect results. Here two sensitivity tests are performed:

1. **Capital land and construction costs**
2. **Operational waste treatment costs**

While higher and lower tests are performed for the above model components, these two aspects are chosen for specific reasons. Lower assumed costs for the first sensitivity test mimic a processing capacity increase from an existing entity where capital requirements are reduced. The second test describes a scenario where a processor can establish opportunistically co-located in such a way that an aspect of their operating costs is reduced. Wastewater treatment is used here in part because of the array of possible alternatives to the treatment model that is assumed in the central financial analysis of this chapter.

5.4.1 Sensitivity 1: capital land and construction costs

The results of sensitivity test 1 are outlined in Table 5.4, and include a 20% reduction (lower) and increase (upper) increase to land and construction costs. These changes flow through to the capital and total cost lines before ultimately affecting the project NPV. A 20% reduction in land and construction costs has a material impact on the viability of the project delivering a 40% increase in the NPV (when excluding transport costs), albeit off a small base.

This test indicates that options where capital costs can be minimised are likely to be worthy of consideration. Conversely the upper bound test also demonstrates that failure to minimise such important costs may substantially impact the financial viability of an early-stage wool processor project.

Table 5.4: Results of sensitivity test 1 to Metropolitan Victoria – wet processing only, FY24-54

Item	Metro VIC Wet only	Lower sensitivity (-20%)	Upper sensitivity (+20%)
Total capital costs	**33.8**	*28.7*	*38.9*
Total operating costs	**143.4**	143.4	143.4
Total costs	**177.2**	*172.1*	*182.3*
Transport cost	**12.7**	12.7	12.7
Total revenue	**253.5**	253.5	253.5
NPV			
- **Inc. transport**	**0.0**	*5.1*	*-5.1*
- **Ex. transport**	**12.7**	*17.8*	*7.6*

Source: Deloitte Access Economics
Notes: All values are estimated on escalated prices, dollar values are present value terms, discounted at 7%

5.4.2 Sensitivity 2: operational waste treatment costs

The results of sensitivity test 2 are outlined in Table 5.4, and include a 20% reduction (lower) to effluent treatment costs alongside a 20% increase (upper). These changes flow through to the operational and total cost lines before ultimately affecting the project NPV. Like sensitivity test 1, a 20% reduction in waste treatment costs also has a material impact on the viability of the project, delivering a 24% increase in the project NPV (when excluding transport costs), albeit also off a small base.

This test indicates that options to establish early-stage processing where aspects of operational can be materially minimised are likely to be worthy of particular consideration. This might include for example strategic co-location opportunities such as the disposal of effluent to land (as this test aims to mimic), or other opportunities involving costs incurred with energy or water use. The upper bound test also demonstrates that relatively large increases to specific opportunity costs may substantially impact the financial viability of an early-stage wool processing project.

Table 5.5: Results of sensitivity test 2 to Metropolitan Victoria – wet processing only, FY24-54

Item	Metropolitan Vic.	Lower sensitivity (-20%)	Upper sensitivity (+20%)
Total capital costs	**33.8**	33.8	33.8
Total operating costs	**143.4**	*140.2*	*146.6*
Total costs	**177.2**	*174.0*	*180.4*
Transport cost	12.7	12.7	12.7
Total revenue	**253.5**	253.5	253.5
NPV			
- **Inc. transport**	**0.0**	3.2	-3.2
- **Ex. transport**	**12.7**	15.9	9.5

Source: Deloitte Access Economics
Notes: All values are estimated on escalated prices, dollar values are present value terms, discounted at 7%

5.5 Conclusions

The two-stage analysis undertaken here has found that the most likely option to succeed financially is an early-stage processor in Metropolitan Victoria that wet processes 15 million kilograms per annum. This configuration provides the same level of supply chain risk mitigation potential as a wet and dry processor, but at substantially lower cost.

The estimated net present value and internal rate of return are estimated to be relatively modest indicating that successful establishment is likely to be financially challenging. This finding is consistent with the outcomes of Phase 1 which identified attracting private investors as a key barrier to growing processing capacity in Australia.

While the analysis identifies a preferred option, it is important to note that other locations and processing systems could viably lead to an increase in Australia's wool processing capacity. This is highlighted by the results of the financial analysis which show relatively similar headline results when comparing different locations and whether a processor would undertake wet processing alone, or in conjunction with some dry processing.

Much of the difference in results across the options is driven by location specific energy inputs. These do not include connection costs, but are informed by publicly published data on stage based charges. With global energy markets disrupted by the impacts of COVID and Russia's war in Ukraine, the energy inputs used here are substantially higher than in recent history. For this reason the regional differences in energy costs are likely more pronounced than they would have been in previous analyses. Notwithstanding, consideration of energy use across locations is likely to be even more pronounced in the future as the Australian government targets decarbonisation across the economy including in industrial sectors.

One possible pathway to improve the financial return of a scouring facility is to pursue 'opportunistic' collaboration or co-location that enables minimising specific wool processing cost components. This includes for example, engaging the existing industry to expand their processing capacity or developing new capacity that can use partnership arrangements to cost effectively gain access to water or energy, or even dispose of effluent.

While the financial analysis provides a useful tool for comparing the financial viability of specific options, industry consultation advised a range of other non-financial factors are equally important. This includes for example being able to operate with flexibly in absence of large capital costs and the increased need for wool processing employment to be supported by a workforce with appropriate skills and qualifications, particularly in areas of technical science and research.

6 Implementation

This section outlines the methods taken to deduce the most appropriate procurement and delivery strategies to implement the facility.

6.1 Possible funding pathways

As this project is yet to secure a project sponsor/owner the next steps are not able to be clearly defined. However, WPA as an industry body would not be an appropriate owner to take the project through the next phase but will remain as a key stakeholder. Table 6.1 below outlines the potential next steps and pathways which are open to WPA.

Table 6.1: Potential next steps/pathways

Pathway	Details	Key considerations	Next steps
National Reconstruction Fund (NRF)	Loan/equity/guarantee from the NRF to support delivery of the facility.	Clear articulation of the facility's 'value add' in the agricultural sector and/or in advanced manufacturing. Form of financial support – what financial contributions will be made by the sector, and what is therefore expected from government? What contributions have already been made (e.g., land, operator)	Engage with DISER Commonwealth Government to understand next steps for developing co-investment plan for consideration.
State government grant programs	Grant / tax relief from state programs (e.g., Business Victoria) to support delivery and operation of facility	As above	Engage with Made in Victoria to understand 1) bundle of suitable incentives and 2) next steps for applying
Institutional investment	Long term investment from institutional investor in construction and operation of facility.	Form of investment – determine what type of investment is needed and whether this aligns with the institution's mandates. Terms of investment – are they the asset owner? Is government also party to the asset and operations? Would WPA (or equivalent operator) lease the facility from them?	Develop investment prospectus articulating investment opportunity for facility. Identify potential investors with aligned investment mandates. Test and refine opportunity with select group.
Unsolicited / market led proposal	Proposal requesting state government support for development of facility.	Unique proposition – why is WPA uniquely positioned for government support over and above other industry groups? Ask of government – what is needed from government and why, and what will other parties be contributing?	Determine unique proposition and ask of government. Request pre-submission meeting with Victorian Department of Treasury and Finance / NSW Department of Enterprise, Investment and Trade
Government policy initiative and supporting business case	Advocacy and lobbying to persuade government to include facility in upcoming policy initiatives and fund in relevant budget.	Level of government and relevant ministerial portfolio/ agency – which level of government and portfolio are best to approach? Government contribution – contributions required from government (land, funds, guarantee etc)? Timeframes – what is the timeframe for delivery of the facility to gain maximum benefit?	Determine whether to approach state or federal government and identify best placed ministerial portfolio and agency. Distil value proposition, desired timeframe, government contribution required and expected contribution from industry. Engage with relevant minister and agency heads.

6.2 Procurement and Delivery Strategy

The high-level strategy to deliver the program would see further work in the next stage to:

- Confirm preferred option that includes planning, design, staging, and development with detailed costing.
- Develop a preferred commercial delivery model and procurement strategy.
- Further communicate and consult with affected stakeholders, industry, and the market.

The ensuing sections outlines the methods undertaken to deduce the high-level strategy and assist in clarifying how the project may best be delivered. However, all findings in the subsequent sections would be subject to change as the project evolves. .

6.2.1 Procurement Strategy Objectives

The first step in developing the procurement strategy was establishing the objectives that will shape the delivery strategy. They are described below in Table 6.2.

Table 6.2: Procurement Strategy Objectives

Objective	Detail
Increase the volume of wool processed in Australia	To protect commercial sovereignty of the wool supply chain - initial enabling activities to forward fund and deliver: • High value strategic interventions to capitalise on the 'Australia' brand reputation. • Provision of industry enabling infrastructure. • Land and infrastructure provision to achieve self-sustaining delivery model.
Offer competitive tension in the market	To deliver land and facility at lowest cost – cost competitive diversification in international markets – attraction of industry and supporting local supply chain growth: ○ Creating and delivering on the value proposition for industry and the ability to attract and convert investment opportunities. ○ Creating job opportunities in regional areas which will be compelling for business investment and attractive for people. ○ Creation of investment partners to derive further value through synergies of activity between industry and education.
Align interests between the new wool processing facility and the existing Australian wool industry	Achieving sufficient scale at the facility: ○ To operate competitively. ○ Deliver investment confidence. ○ Support and stimulate industry.
Actively curate the development of the delivery process	To ensure the long-term vision and industry value proposition is achieved over time via a self-sustaining model: ○ To ensure the assets are maintained over time so that the initial investment has a sustainable long-term funding model.
Strive for leading sustainability outcomes	Through the commercial frameworks that are integrated seamlessly throughout the development and meets the needs of the market – to harness the capability and appetite of the private sector and partner organisations to deliver physical works, through: ○ Managing delivery and risk in construction and design through private sector / partner organisation involvement ○ Access to capital and development of physical works
Provision of a clear exit strategy	For government in a way where long-term commitments and vision can be preserved, through: ○ Portfolio structuring, including the Government's role in ownership, investment, and curation to optimise value to taxpayers.

6.2.2 Commercial Objectives

Secondly, the commercial objectives were identified, and articulate what should be achieved to successfully implement the project. These have been detailed in Table 6.3 below.

Table 6.3: Commercial Objectives

Objective	Details
Delivery timeframe (ability to perform to milestones)	Achieve consistency of delivery timing by an external party across similar scope of work.
Planning & regulatory environment	Management and alignment with required planning and regulatory frameworks.
Financial impact, cost, and budget certainty	Obtaining pricing certainty between budgeted costs and actual costs. As well as achieving consistency of pricing between contracts.
Access to capital	Ability to attract and access capital markets (both government and private).
Optimised market capacity and appetite	Optimised private sector capacity, capability, leveraging of networks to attract target businesses, and appeals to the local developer market, and provides the ability for specialist providers to be selected for unique requirements.
Construction and market risk	The ability to allocate risks to the private sector where they are better placed to manage them. For example, outsourcing risks such as: defining scope of work packages and cost escalations of materials.
Flexibility and control	Ability for to influence changes after a contract is signed. This includes allowing for changes in the number of sites in the package, design details, and to address changes in Program delivery requirements.
Product, place value proposition, and innovation	Ability to create and deliver on the value proposition for industry by attracting and converting opportunities and support innovation.
Post Occupancy Service	Degree of maintenance and effective management of the facility.
Exit strategy	Government ability to sell down assets and recycle capital outlay on assets.
Scope management	Clear delineation of responsibilities between each delivery party.

With these objectives now established, various criteria were appointed to each objective, with a corresponding score from 0 to 4, to allow procurement and delivery options to be assessed in accordance with their ability to meet the objectives. Refer to Commercial Objectives for a detailed breakdown of the objective criteria.

6.2.3 Packaging and Bundling of Works

The following sections considers how the construction, development, and management of the facility could be undertaken and how it could be packaged for improved efficiency. Table 6.4below identifies the potential work packages which the early-stage processing facility could be split out into.

Table 6.4: Potential work packages

Package	Sub-Packages	Scope Specifics
1. Site Civils and Construction Works	-	• Site security • Property management and maintenance • Construction compound • Demolition • Stormwater control, surveying, fences • Site sheds • Utility reticulation • Roads and Services • Site office • Minor services • Bulk earthworks • Site establishment • Remediation • Site access
2. Land Procurement	-	• Acquisition of the lots that are considered necessary for development: ○ Warehouse site and processing facility ○ Effluent treatment area ○ Access roads
3. Utilities	3A: Effluent treatment facility	• Sustainable utility infrastructure for water harvesting, treatment, and distribution
	3B: Integrated utilities	• Sustainable utility infrastructure for onsite generation, storage, and distribution of renewable energy
4. Specialist kit provision	5A. Wet processing equipment	
	5B. Dry processing equipment	
5. Estate Management		• Operate and maintain site. • Operate and maintain roads, utilities, water. • Utilities operations

These packages were then all bundled in different combinations to be assessed against the delivery considerations identified in Section 6.2.2. The bundled packages are:

3. All separate packages
4. Combine Site Civils and construction work and utilities.
5. Combine Site Civils and construction work, utilities, and estate management.
6. Combine all works aside from land procurement.
7. Combining all works in one package.

Table 6.5 below depicts the assessment of the packaging options against the delivery considerations.

The key takeaways of this assessment indicate that it is likely that packaging will help drive efficiencies and alignment as opposed to entirely separate packages. Options 2-6 align well with several criteria should the right circumstances warrant it. Therefore, all options should remain under consideration and be informed by the market sounding and expression of interests (EOI).

Procurement Package provides detail on the assessment of each of the available delivery models (e.g., design and construct, construct only) against the delivery considerations identified in Section 6.2.2. for the above packages.

Table 6.5: Packaging options analysis

	Packaging Option				
Delivery Considerations	1	2	3	4	5
	All Separate Packages	Combining Site Civils and Construction works, and Utilities	Combining major construction and management activities	Combine all works aside from Land Procurement	Combining all works in one package
Delivery timeframes (ability to perform to milestones)	1	2	2	3	3
Planning and regulatory environment	1	3	3	3	3
Financial impact, cost, and budget certainty	1	2	2	3	3
Access to capital	1	2	2	1	1
Optimised market capacity and appetite	2	3	2	1	1
Construction and market risk	2	2	2	1	1
Flexibility and control	3	3	3	2	1
Product, place, value proposition execution and innovation	1	3	2	1	2
Post occupancy service	1	1	2	3	3
Exit strategy	2	2	1	1	1
Scope management	1	2	2	3	3
Score out of 33	**16**	**25**	**23**	**23**	**22**
Rank	**4**	**1**	**2**	**2**	**3**

6.3 Program Risk Management

Risk management will be a critical success factor for the development of an early-stage processing facility, and for the implementation, realisation of expected benefits, and overall project outcomes. The formal risk management framework ensures the effective monitoring and management of risks, assuring that appropriate mitigation and management measures are in place.

All major risks associated with the project, including direct and indirect risks, have been identified and assessed, and can be found in Appendix A.

A summary of the key risks, including mitigation strategies for the two preferred options are outline below in Table 6.6.

Table 6.6: Preferred option risk analysis

		Starting Risk			Post mitigation risk	
#	Risk	Regional NSW	Metro VIC	Mitigation	Regional NSW	Metro VIC
	The processing facility does not receive an adequate variety of wool fibres to produce a desired end-product	Medium	Medium	During the stakeholder engagement phase, engagement with producers will be paramount to ensure that there is an adequate supply chain in place before construction occurs.	Low	Low
	Water availability becomes scarce due to drought and usage restrictions.	Medium	Medium	Water restrictions in many areas are applied only in extreme circumstances to industry. Therefore, reducing the risk to business.	Low	Low
	Supply chain or input disruptions create cost challenges for capital works phases	High	Medium	Rigorous EOI phase ensures that supply chain risk is limited, and appropriate mitigation activities are in place.	Medium	Low
	Policy environment adjusts impacting facility's ability to dispose of effluent	Medium	High	A detailed management plan will be developed to ensure that there are contingencies in place for the facility to adapt over time to new effluent restrictions	Low	Medium
	The shift towards net zero causes increased GHG emissions restrictions on the industry	Medium	Medium	A detailed environmental management plan will be developed to ensure that there are contingencies in place for the facility to adapt over time to new emissions restrictions.	Low	Low

6.4 Project Governance

To deliver the project successfully, the following will be required:

- A governance framework which adapts over time for the whole facility's life and supports the implementation and management of the long-term vision and aspirations of the facility.
- A rigorous governance structure, established with effective program and project management, budget, and risk management.
- Effective communication, stakeholder engagement, and consultation.

The objectives of the early-stage processing facility program governance include:

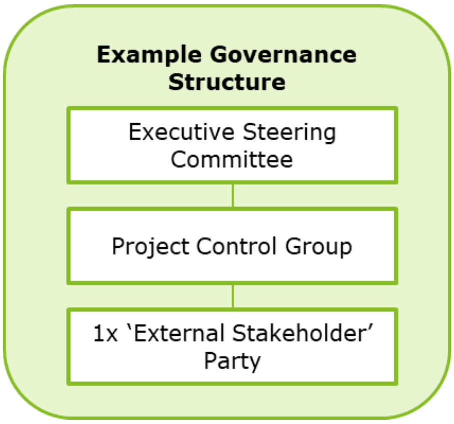
- Establishment of a transparent authority framework to manage delivery.
- Provision of a clear structure of decision making and endorsement of key program documents and strategies.
- Provision of a clear structure of decision making and endorsement of program budget and scope.
- Track success of the facility as it evolves over time, including future investment options.
- Coordination between stakeholders.
- Establishment of effective lines of communication between groups and teams.

To comply with Infrastructure Australia's guidelines for a business case, a detailed governance structure will need to be identified. The questions that will require answers to comply with Infrastructure Australia, include:

- Who owns the proposal (project sponsor)? – this is typically a lead government agency.
- Who is responsible for the proposal outcomes?
- Who is responsible for approving key decisions?
- Who will manage the proposal?
- How will it be resourced?
- Who is responsible for monitoring the costs, benefits, and risks?

At this stage in the delivery, these roles will be assigned once the owner of the proposal is identified. It has been assumed that WPA will not be the project sponsor. Figure 6.1 provides an high-level example governance structure of what would be required.

Figure 6.1: Example governance structure



However, it is envisaged that while WPA would not seek to be in the Executive Steering Committee or Project control group, they would seek to continue to be a key external stakeholder.

6.5 Asset Ownership and Management Strategy

The Asset Ownership and Management Strategy provides a high-level approach to the management of the facility's assets during the design development and construction. As the scope if further defined, the strategy will be converted into an Asset Ownership and Management Plan. The plan will be subject to regular updates as the program moves through the design development, delivery, and operations phase.

The role of and responsibility of the relevant parties in the planning, acquisition, operation, and maintenance of assets delivered by this program are yet to be identified. However, upon deciding on an appropriate delivery model, these roles and responsibilities will be allocated to the corresponding phases.

6.6 Stakeholder Management Plan

The stakeholder Management Plan ensures that the project solutions satisfy customer needs and comply with definitions based on evidence gathered on:

- Customer needs and requirements.
- Relevant external stakeholder input.
- Relevant internal stakeholder input.

How this project will action this is detailed overleaf in Table 6.7.

6.7 Compliance

The owner and/or project sponsor will consider the appropriate safety and statutory planning obligations required for the development of an early-stage wool processing facility.

Upon determination of the final location, the key policies that the project must align to, and how compliance will be achieved and validated will be informed.

Table 6.7: Typical requirements of a stakeholder management plan

Requirements	Details
Customer needs	Throughout the drafting of the business case, there has been appropriate industry engagement which has helped form the shortlist of options. Further customer input will be required in the detailed feasibility assessment
Relevant external stakeholders	Once the delivery model is determined, stakeholder engagement will occur. These stakeholders could include: Federal Government State Government Local Government Local Community Groups Environmental Protection Authority Industry Group
Relevant internal stakeholders	As per the above, the delivery model selected will determine the governance and subsequent internal stakeholders.

6.8 Change Management

Consideration has been given to how the project will impact the identified stakeholders, and what support is required. A summary of identified key activities is demonstrated below.

Table 6.8: Change Management key phases and activities

Project phase	Key activity
Planning	Prepare communication and engagement plan (external and internal stakeholders)
	Establish external and internal web presence
	Establish communication channels
	Manage initial engagement with key stakeholders
Consultation	Plan and manage external and internal engagement events
	Prepare narrative and key messages
	Prepare collateral
	Manage external and internal comms channels
	Capture and analyse external and internal feedback
	Produce reports on engagement activities and feedback received
Construction	Prepare/update Communication and Engagement Plan (internal and external stakeholders)
	Plan and manage external and internal engagement events
	Prepare construction notifications (internal and external)
	Respond to Builder's Disruption Notices (stakeholder impacts)
	Establish complaint management process

Handover & Commissioning	Prepare communication plan for people, equipment, and materials
	Prepare materials for site tours, orientation, and mandatory training
	Prepare operational readiness checklists

6.9 Benefit Realisation Plan

Benefits realisation management is an established practice of ensuring a projects intended benefits and objectives articulated in the business case are realised. Various state and federal guidelines require benefits realisation plans to be implemented for the project business case.

Active benefits realisation is required throughout the investment lifecycle from initial planning, to delivery, and operational phase after the commissioning of new services or facilities. A successful project is not only measured by time, cost, and infrastructure delivery, but also measured by the addressing the problems and opportunities which underpins the investment decision.

Table 6.9 provides a summary of the approaches and responsibility that will need to be developed and allocated once the owner/sponsor of the project is identified, and the governance structure is developed.

Table 6.9: Benefits

Benefit objective	Monitoring and reporting systems and responsibilities
Volume of wool processed in Australia	To be developed and allocated once the owner/sponsor of the project is identified, and the governance structure is developed.
% of Australian wool processed in any one country reducing so supply chain is more diverse	
Aligned interests between new facility and existing industry	
Self-sustaining delivery model	
Sustainability outcomes	
Clear exit strategy	

The benefits plan and register will then be developed to include the main objectives that are anticipated to be realised by the project, and what systems are going to be put in place to monitor and report the findings.

6.10 Sustainability

The federal and state governments all aspire to provide a world class sustainable system that meets customer expectations and optimises the economic development of the country. In doing this the government is committed to managing the impact of the environment and operating in an environmentally sustainable manner.

Upon finalising a location for the facility, a detailed alignment against government sustainability guidelines will be undertaken.

Appendix A Options analysis

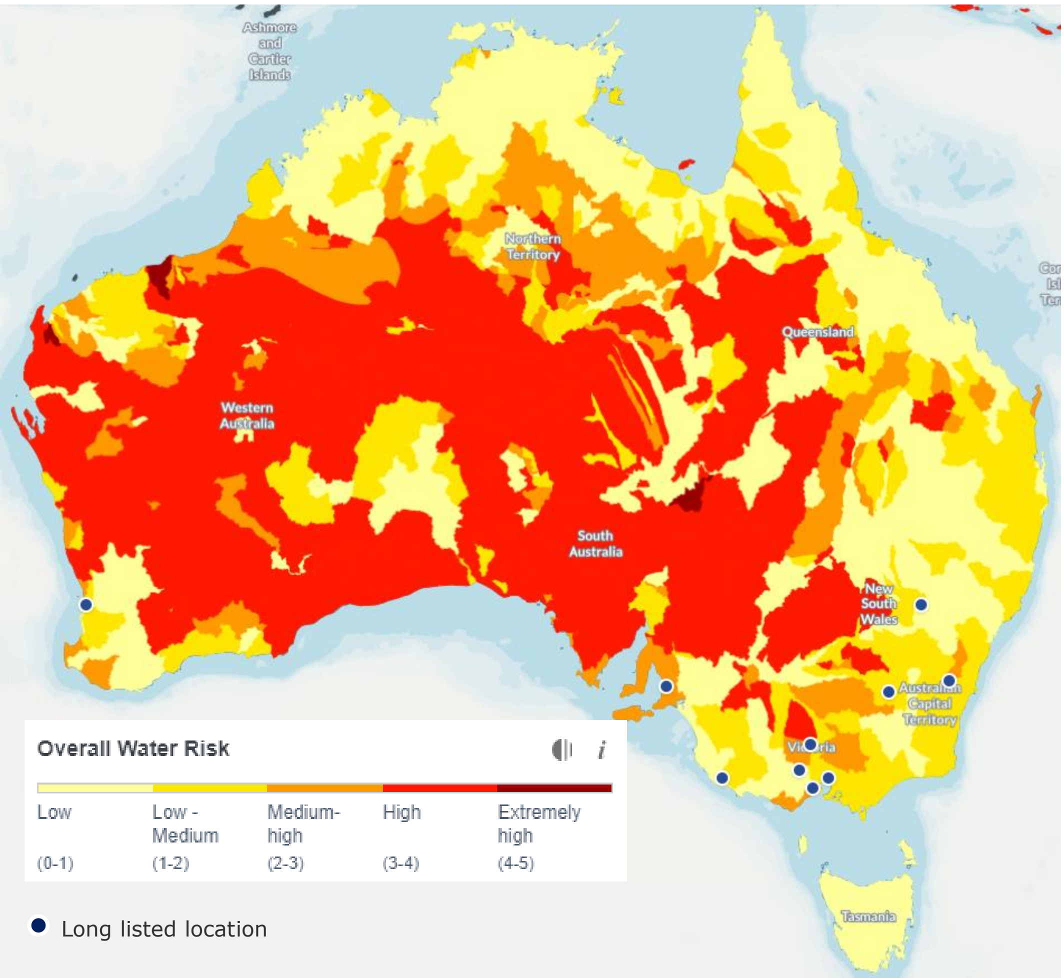
This appendix details the data underpinning the multi-criteria and risk analyses undertaken as part of the options analysis.

A.1. Water availability

Water is a key input for early-stage processing, used primarily in scouring. A typical scour uses around 10 litres of water per kilogram of wool processed. Having sufficient water available is of critical importance. The availability of water across the shortlisted locations was assessed using Aqueduct's (n.d.)[50] Water Risk Atlas, which maps current and future water risks across the world.

Overall water risk was used to inform the availability of water across assessed locations, with the map detailing rating geographies from low to extremely high (Figure A.1).

Figure A.1: Overall water risk for Australia from Aqueduct's Water Risk Atlas



Source: Aqueduct[50]

A.2. Water quality

Water quality is also important for a scouring enterprise, as it affects the ability to effectively clean the wool and affects operating costs through maintenance. An array of data was collected to inform differences in water quality across the assessed locations and is reproduced in Table A.1. Consultation with stakeholders advised that water hardness (i.e., the amount of dissolved calcium and magnesium in parts per million), was of particular interest.

Table A.1: Water quality data for selected locations

State	Region	Location	pH	Turbidity	Turbidity-Max	Electrical Conductivity	Hardness (ppm)	Solids (TSS)
NSW	**Central Western NSW**	Dubbo Parkes Forbes	9.2	5.4		255.7	150	
	Riverina	Wagga Wagga		11.1		132.7	60	
	Southern Tablelands	Goulburn		-		-	132	
SA	**Metro Adelaide**	North Adelaide	7.5	0.3	11	363	192	181.5
	Green Triangle	Mt Gambier	8.2	0.2	1.6	266	102	133
WA	**Metro Perth**		7.73	0.3	0.4	782.7	93.86	391.4
VIC	**Loddon Campaspe**	Bendigo	7.9	-	0.4	354.1	75.86	177.1
	Central Highlands	Ballarat	8.4	-	0.5	432.9	93.56	216.4
	Metro Melbourne		7.49	-	0.91	93.07	21.43	46.54
	Barwon	Geelong	7.36	-	0.78	298.5	39.8	149.25

Sources: Greater Western Water[60]; Central Highlands Water[61]; Goulburn Mulwaree Council[62]; SA Water[63]; Barwon Water[64]; Water Corporation[65]; Dubbo Regional Council[66]; Parkes Regional Council[67]; Riverina Water[68]

A.3. Electricity connection

Use of electricity is a major input for early-stage processing across both wet and dry stages. A wet processing plant draws a substantial amount of electricity in its operations. A facility processing 15 million kilograms of greasy wool per annum is expected to consume around 7 GWh of electricity each year.

The financial analysis incorporates variation in costs across individual locations, however consultation with industry stakeholders indicated that earlier assessment of this input would be appropriate for the business case. In particular industry advised assessing the ability to connect to local distribution networks. A comprehensive assessment of connection issues requires a detailed understanding of the site specifics, which is outside the scope of this analysis. The multi-criteria analysis instead focused on identifying which regions had appropriate infrastructure, with which a processor could connect.

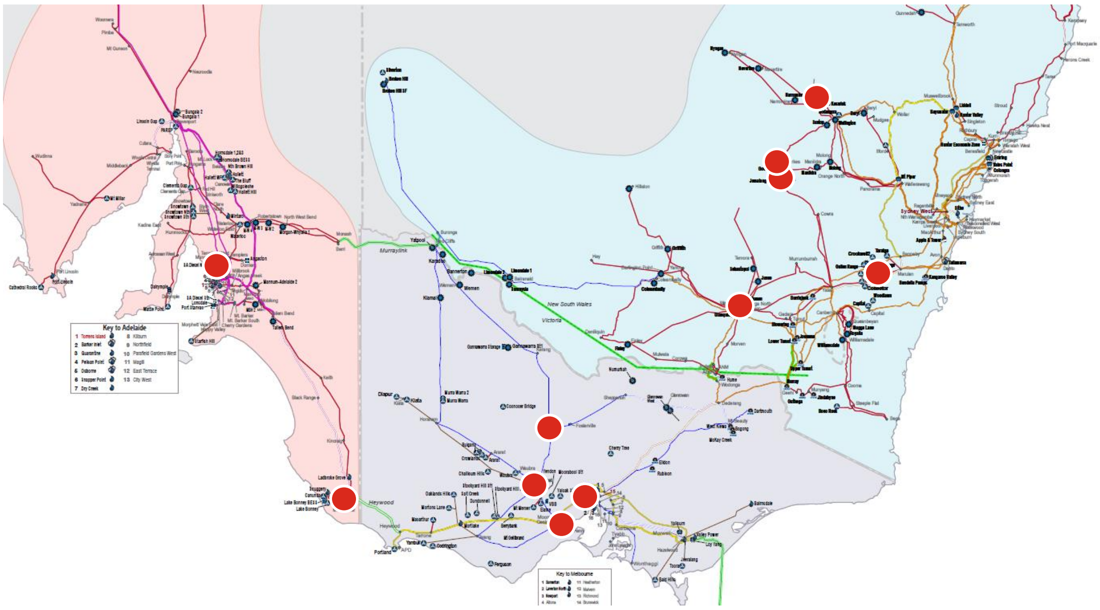
Maps of Australian electricity infrastructure (detailed in Figure A.2 and Figure A.3) were used to assess the region's potential to connect to distributional infrastructure.

Figure A.2: Electrical distribution infrastructure in West Australia

Source: Lu Blakers and Stocks (2017)[69]

[60] Greater Wester Water CWW Drinking water quality report (2021) https://www.gww.com.au/sites/default/files/2022-10/CWW_Drinking_Water_Quality_Report_2021.pdf
[61] Central highlands Water, Drinking quality report (2020-21) https://www.chw.net.au/mvc/K12WebApi/media/Water-Quality-Reports/2020-21-CHW-Water-Quality-Report.pdf?ext=.pdf
[62] Coliban Water, 2019/2020 Annual report https://www.chw.net.au/mvc/K12WebApi/media/Water-Quality-Reports/2020-21-CHW-Water-Quality-Report.pdf?ext=.pdf
[63] SA water, Your drinking Water (n.d.) https://www.sawater.com.au/water-and-the-environment/safe-and-clean-drinking-water/your-drinking-water-profile
[64] Barwon water (Annual Drinking Water Quality Report (2021-2022) https://www.barwonwater.vic.gov.au/__data/assets/pdf_file/0032/295493/Annual-Drinking-Water-Quality-Report-2021-2022.pdf
[65] Water Corporation, Annual report Drinking water quality (2019) https://www.watercorporation.com.au/-/media/WaterCorp/Documents/About-us/Our-performance/Drinking-Water-Quality/Drinking-water-quality-annual-report-2019.pdf
[66] Dubbo Regional Council, Water quality treatment (n.d.) https://www.dubbo.nsw.gov.au/Our-Region-Environment/Water-Sewerage-and-Drainage/water-quality-treatment
[67] Parkes Regional Council, Water Savings tips (n.d.) https://www.parkes.nsw.gov.au/Services/Customer-service/Rates-charges-and-online-payments/Water/Water-saving-tips
[68] Interviews with Riverina Water advised the local water was moderately soft
[69] Lu Blakers and Stocks (2017) 90–100% renewable electricity for the South West Interconnected System of Western Australia <https://www.sciencedirect.com/science/article/pii/S0360544217300774#fig2>

Figure A.3: Electrical distribution infrastructure in southeast Australia



Source: AEMO (2023)[70]

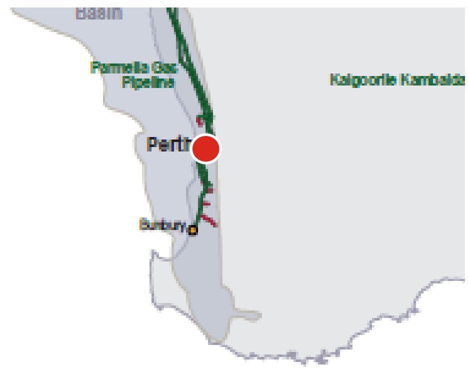
A.4. Process heat

Process heat is a significant input mainly used in scouring to dry wool after wet processing. A facility processing 15 million kilograms of greasy wool per annum is expected to consume around 93 TJ of gas each year.

The financial analysis incorporates variation in costs across individual locations, however consultation with industry stakeholders indicated that earlier assessment of this input would be appropriate for the business case. In particular industry advised assessing the ability to connect to local distribution networks. A comprehensive assessment of connection issues requires a detailed understanding of the site specifics, which is outside the scope of this analysis. The multi-criteria analysis instead focused on identifying which regions had appropriate infrastructure, with which a processor could connect.

Maps of Australian gas infrastructure (detailed in Figure A.4 and Figure A.5) were used to assess the region's potential to connect to gas infrastructure as well as information on pipeline capacity detailed in Table A.2.

Figure A.4: Gas distribution infrastructure in West Australia



Source AEMO[71]

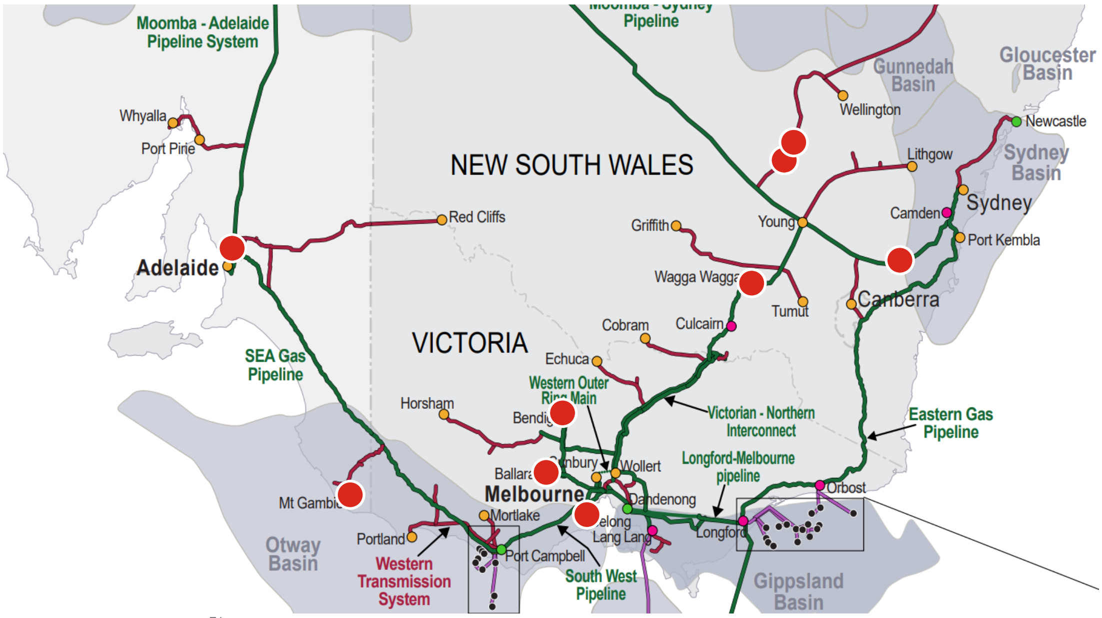
[70] AEMO REGIONAL BOUNDARIES for the NATIONAL ELECTRICITY MARKET <https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/maps/nem-regional-boundaries-map-web.pdf?la=en>

Table A.2: Selected information for gas pipelines servicing assessed options

Gas network		Pressure (kPa)		Capacity
Location	**Pipeline**	**Minimum**	**Maximum**	**TJ/day**
Central Western NSW	CWP	1,750	9,400	13
Riverina	MSP	1,750	8,509	151
NSW Southern Tablelands	MSP	1,750	6,200	489
North Adelaide Area	MAPS	na	7,320	249
Green Triangle	SESAP	4,950	6,200	40
Metropolitan WA	PGP	2,000	5,610	11
Goldfields	VTS	na	10,000	1,030
Metropolitan Victoria	VTS	na	10,000	1,030
Barwon region	VTS	na	10,000	1,030

Sources: Various embedded

Figure A.5: Gas distribution infrastructure in southeast Australia



Source: AEMO (2023)[71]

A.5. Employment

Employment is a major input to both scouring and dry processing of wool. A 15 million kg combined wet and dry processor could employ around 140 people. Assessing the potential for a region to access local labour hinges on balancing both local supply and competing demand. Here an index was constructed to inform this, by comparing regional:

[71] AEMO About the gas bulletin board <https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/maps/nem-regional-boundaries-map-web.pdf?la=en>

- unemployment — to inform what degree there is labour available in a region that is not currently being utilised
- Internet vacancy index— to assess how competitive the regional market is for labour demand

Data collected during this analysis, combined with industry consultation has advised that many of the jobs required for early-stage processing are relatively low skilled. As such the ratio of unemployed persons to relevant number of job advertisements in a region has been used to assess the suitability and to measure the available workforce compared to competition for workers. Results for all Australian regions were used to construct national rating quartiles, which were used to rate each location between 1-4 (for example, 4 is the highest rating and reflects a score within the top national quartile range).

Table A.3: Regional MCA scoring from employment index, and input indicators.

State	Region	Example location	Unemployment indicator	Job ad indicator	Employment index	MCA score
NSW	**Central Western NSW**	Dubbo	15,547	2,880	5.3977	4
		Parkes Forbes	3,570	2,040	1.7497	2
	Riverina	Wagga Wagga	5,931	2,363	2.5104	2
	Southern Tablelands	Goulburn	5,100	1,258	4.0538	4
SA	**Adelaide**	North Adelaide	42,677	21,628	1.9732	2
	Green Triangle	Mt Gambier	6,589	1,345	4.8970	4
WA	**Perth**	Kwinana	58,356	44,592	1.3087	1
VIC	**Loddon Campaspe**	Bendigo	16,188	4,147	3.9035	4
	Central Highlands	Ballarat	3,765	1,497	2.5153	2
	Melbourne	Truganina Beveridge	138,196	112,781	1.2253	1
	Barwon	Geelong	10,449	4,203	2.4861	2

Source: ABS[72]; Jobs and Skills Australia[73]

A.6. Industrial land availability

Wool processing would require being established in industrial zoned land. As such consideration of a region's potential capacity to supply such land is an important consideration for the development of early-stage processing. A range of indices were combined to inform industrial land availability in each region:

- Market activity - The average volume of transactions. A higher (lower) volume of transactions indicates an (in)active market with a relatively good (poor) supply of acquisition opportunities.
- Land costs -The range of land value rates on a $/sqm basis derived from a sample of sales transactions within the location analyses on an improved basis
- Adaptive re-use opportunities - Brownfield site opportunities that can be readily converted to the required use

Strategic planning framework - Greenfield site opportunities that are being delivered or will be delivered through strategic planning frameworks.

[72] ABS, Labour Force (2023) <https://www.abs.gov.au/statistics/labour/employment-and-unemployment/labour-force-australia/latest-release>
[73] Jobs and Skills Australia, Internet Vacancy Index (2023) <https://www.jobsandskills.gov.au/data/internet-vacancy-index>

Table A.4: Assessment of regional industrial land development issues

Location	State	Assessment Criteria				Total Score	% of Maximum	Desirability	MCA Score
		Market Activity	Land Cost	Adaptive Re-Use Opportunity	Strategic Planning Framework				
Metropolitan WA	WA	3	10	12	10	35	88%	Desirable	4
Southern Tablelands	NSW	5	6	12	10	33	83%	Desirable	4
Goldfields	VIC	3	8	7	6	24	60%	Moderate	2
Riverina	NSW	3	6	6	10	25	63%	Moderate	2
Central West NSW (dubbo)	NSW	3	10	9	8	30	75%	Moderate	3
Metro Melbourne (west)	VIC	5	2	3	10	20	50%	Undesirable	1
Metro Melbourne (north)	VIC	4	10	3	6	23	58%	Moderate	2
Barwon	VIC	4	8	3	8	23	58%	Moderate	2
North Adelaide area	SA	2	2	9	2	15	38%	Undesirable	1
Central West NSW (Parkes)	NSW	1	10	3	10	24	60%	Moderate	2
Green Triangle	SA/Vic.	1	10	6	2	19	48%	Undesirable	1

Source: Deloitte Real Estate

Appendix B Value for money assessment

B.1. Financial model assumptions

B.1.1. Modelling assumptions

The table below summarises the key assumptions used within the financial appraisal.

Table B.1: Financial Appraisal – Key inputs and assumptions

Key parameters	Assumption	Description
Price Year	Financial Year 2024	The project is assumed to commence from July 1 2023 (financial year 2024). Any costs and revenues accrue from this date.
Evaluation period	30 years	30-year evaluation period has been assumed, in line with the NSW Government Guide to Cost-Benefit Analysis (TPG23-08).
Real discount rate	7%	A 7% real discount rate has been applied in the core analysis, with sensitivities run at 3%, 5%, and 10%.
WACC / Discount rate	9.4%	Provided by the SA Government Department of Treasury and Finance. The WACC represents the true cost of funds/cost of capital to the state for financial analysis purposes. The 'high' discount rate was chosen since the proposal is entirely dependent on external revenues correlated to market conditions. It is different from the economic discount rate, given that the economic discount rate is a notional rate which captures the social opportunity cost of capital.
Inflation	2.5%	Midpoint of the RBA's 2-3% inflation target band.
Real escalation	0%	No QS real escalation allowed for, so assume prices rise in line with inflation.

B.1.2. Time to full capacity

Assumptions relating to facility construction and scaling up of throughput to reach full capacity were built into the financial model. The key assumptions are as follows:

- Capital expenditure for the facility construction is distributed evenly over years 1 – 3.
- No revenue or operating costs are assumed in years 1 – 3.
- 10m kg start-up wet processing volume.
- Wet processing: capacity increases by 4m kg per year.
- Dry processing capacity at 5m kg per year.
- Labour increases proportionally with wool throughput.
- Wet processing machinery is processed incrementally with increasing throughput.
- Revenue increases linearly with wool processed.

B.2. Cost and revenue line items data sources and methods

B.2.1. Land purchase costs

Estimates of land costs in each shortlisted region were derived from a sample of recent greenfield industrial land sales (on a $/sqm basis) in towns and suburbs within the shortlisted regions. A site size of 55,000 square metres was the target, however, actual lot sizes ranged from 20,000 sqm to 180,000 sqm. The specific towns and suburbs where land transactions occurred are listed in Table B.2 underneath their respective shortlisted region.

Table B.2: Towns and cities within each shortlisted region where industrial land price data was obtained

Regional NSW	Metro VIC	Northern Adelaide	Green Triangle
Dubbo	Truganina	North Adelaide area	Mount Gambier
Parkes	Beveridge		Hamilton
Forbes	Geelong		Portland
Wagga Wagga			

Source: Deloitte Access Economics and Deloitte Real Estate

To calculate industrial land values by region, firstly, average land costs per sqm within each town and suburb were calculated by taking an average of the sample lower bound and upper bound values. An average of the town/suburb land values were subsequently taken to derive land rates at the region level. These are detailed in below.

Table B.3: Land purchase cost per sqm assumptions

Regional NSW	Metro VIC	Northern Adelaide	Green Triangle
17.5	120	150	10

Source: Deloitte Real Estate, based on CoreLogic data

There was generally a low number of greenfield land sales transacted in regional towns which resulted in small sample sizes. Data is therefore indicative and subject to variation.

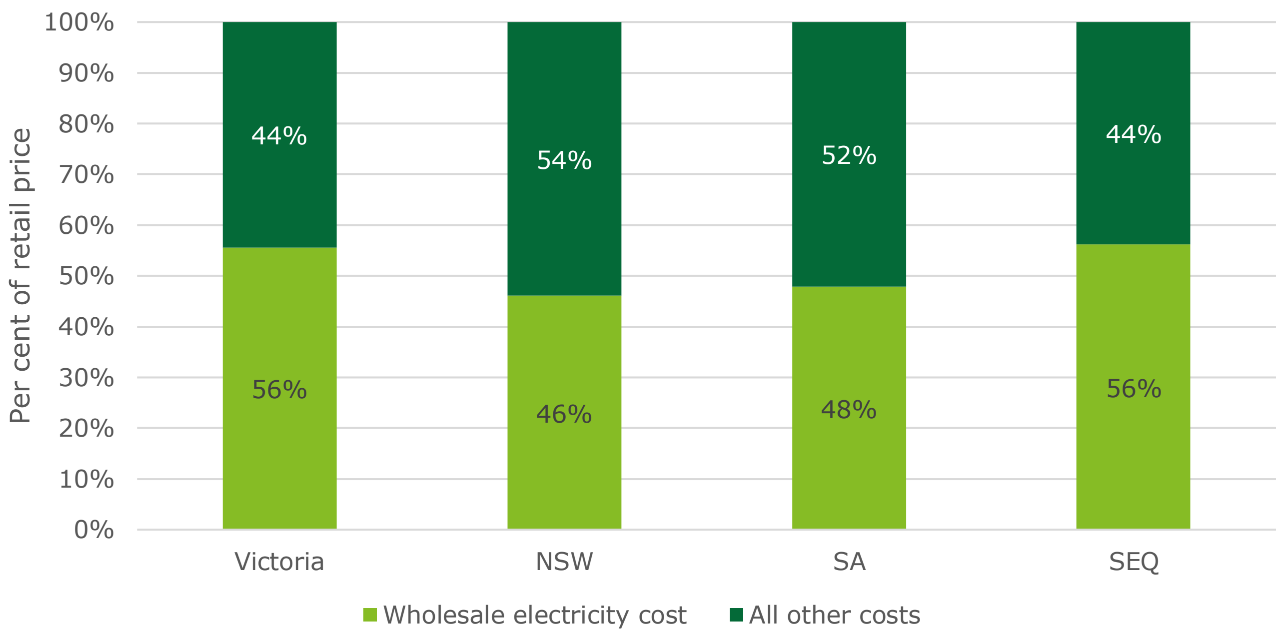
B.2.2. Electricity prices

Data on retail electricity prices paid by large industrial energy users across regions in the National Electricity Market is not publicly available. Large energy users typically sign electricity supply contracts which are commercial-in-confidence.

In lieu of obtaining published data, an estimate of the cost of electricity paid by industrial users was derived using data from the Australian Energy Regulator (AER) and the Australian Competition and Consumer Commission (ACCC). First, a breakdown of retail electricity prices by cost component for small businesses was obtained from the November 2022 edition of the ACCC's National Electricity Market Enquiry. The cost breakdown is known as a 'cost stack.' The ACCC only publishes state-level cost stacks for residential and small business users; the cost stack for industrial businesses is averaged over all NEM regions.

Consequently, the second step involved obtaining the small business regional cost stack data and calculating the deviation in percentage terms of each state's wholesale electricity cost component from the NEM-wide average. The share of wholesale electricity costs (and other embedded costs) of the total retail electricity price differs between NEM states. These percentage deviations were then applied to the NEM-wide wholesale electricity cost share for industrial users to obtain state-level wholesale cost shares. These shares are given in Chart B.1.

Chart B.1: Wholesale electricity cost shares for selected Australian regions



Source: ACCC

Thirdly, wholesale electricity price data was obtained from the AER. The data comprised of quarterly volume weighted average spot prices by NEM region. An average of FY23 prices was calculated for each state, covering Q1 and Q2 2023, and Q3 and Q4 2022.

Lastly, the fourth step involved dividing the wholesale electricity price for each state by the corresponding share of wholesale to total retail price derived in step two. The calculated retail prices for NSW, VIC and SA used in the model are given in Table B.4 below. An average of VIC and SA prices was calculated for the Green Triangle shortlisted location, which encompasses Mt Gambier in SA, and Hamilton and Portland in VIC.

Table B.4: Calculated wholesale electricity prices used in the financial model, $/MWh

Victoria	NSW	South Australia	Vic.-Sth Aus average
198	334	298	248

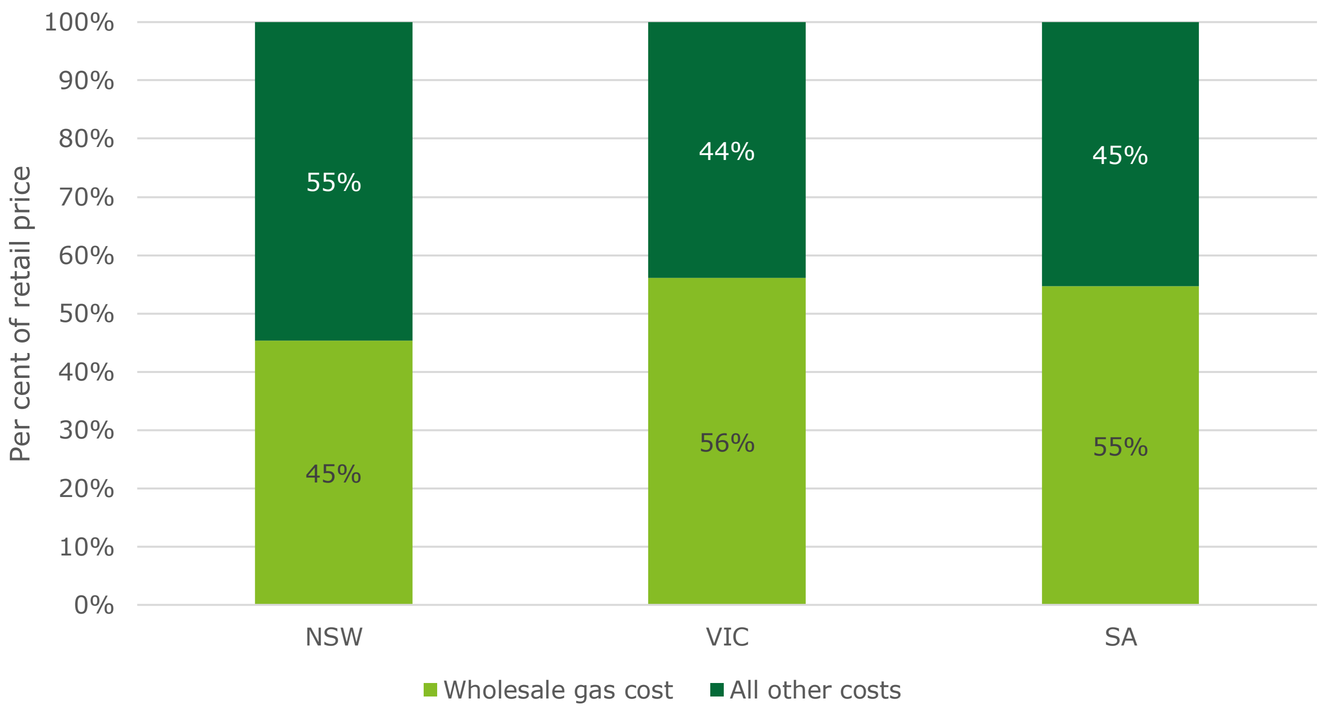
Source: Deloitte Access Economics based on ACCC and AER data

B.2.3. Gas prices

Similarly to electricity, there is no publicly available data on retail gas prices paid by large industrial users. However, the same method used for electricity prices was applied to estimate retail gas rates.

The ACCC's July 2019 gas enquiry interim report contains retail cost stacks by state and user type. Chart B.2 illustrates the cost components of retail gas prices charged to industrial customers. Wholesale gas costs comprise 45% of the retail price in NSW, 56% in Victoria, and 55% in South Australia. Transmission, distribution, and retail costs (including retailer's margin) comprise the remaining share of the retail price.

Chart B.2: Industrial gas price breakdown



Source: Deloitte Access Economics based on ACCC data

Next, quarterly wholesale gas price data was obtained from the AER, both in the Short-Term Trading Market covering NSW and SA, and the Victorian Gas Market. An average of FY2023 prices was calculated separately for each state. The average wholesale price was subsequently divided by the respective share of wholesale to retail price to obtain a retail price estimate for each state. The calculated retail prices for NSW, VIC and SA used in the model are given in Table B.5 below. An average of VIC and SA prices was calculated for the Green Triangle shortlisted location, analogous to electricity.

Table B.5: Calculated wholesale gas prices used in the financial model

State	Victoria	New South Wales	South Australia	Victoria-South Australia average
Calculated retail gas price ($/GJ)	26	38	39	33

Source: Deloitte Access Economics based on ACCC and AER data

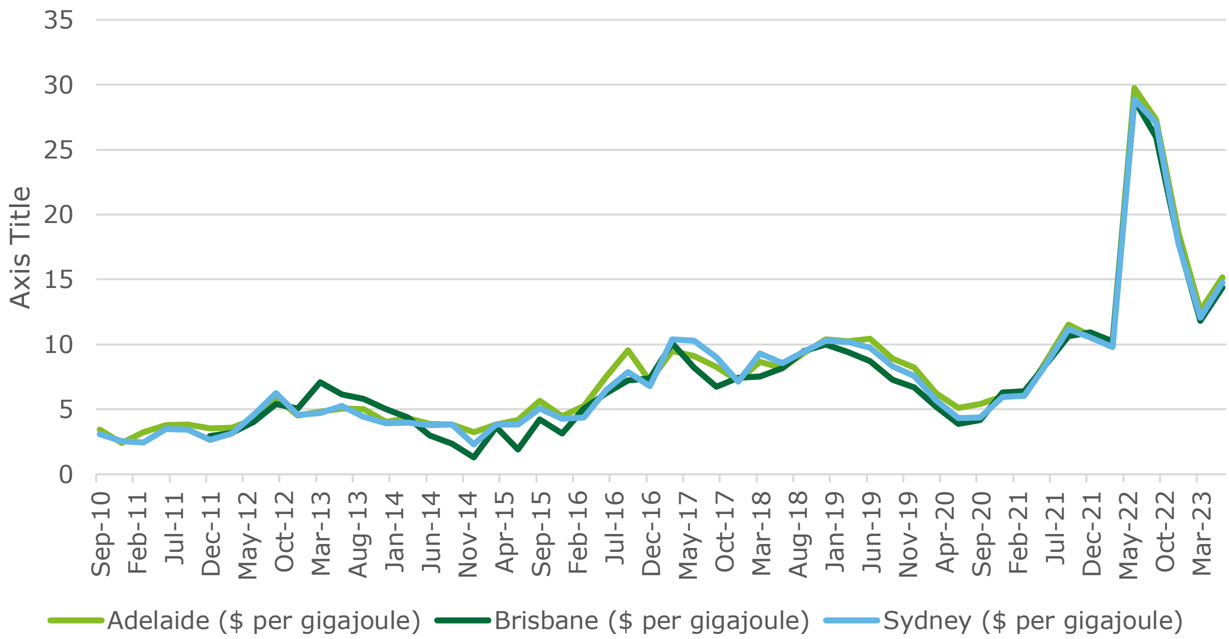
B.2.4. Energy price caveats

The FY2023 average energy prices used in the calculations described above are higher than the medium-term (5 and 10 year) averages. Global energy prices reached historical highs in the second and third quarters of 2022, in part due to rebounding energy demand following COVID lockdowns in 2020 to 2021, as well as reduced gas supply from Russia arising from the war with Ukraine. A one-year average of gas and electricity prices was used instead of medium-term averages to maintain consistency with the currency of other operating costs, including effluent treatment, water, labour and lanolin. It is expected that the energy prices used in the model are upper-bound values; i.e., actual prices faced by the processing plant operator in the future are likely to be lower.

Another challenge associated with using historical energy prices to calculate future prices is that the future state of the energy market is highly uncertain, given the rapid pace of change occurring in the energy system. Electricity prices will likely be influenced by the speed in which new transmission infrastructure and long-term storage is built to accommodate the growing stock of renewable generation. The establishment of a domestic hydrogen market could affect gas prices, where hydrogen can be used as a substitute for gas. Additionally, the future price of fossil fuel commodities, which in turn are influenced by global market dynamics, will also affect energy prices.

The gas prices used in the model are greater than the price forecasts published by AEMO out to 2050, except in the Progressive Change scenario where the slope of the price curves are steeper.

Chart B.3: Gas prices



Source: AEMO

6.10.1 Water usage costs

Water usage charges were obtained from publicly available rates and charges documents published by regional councils and metropolitan water authorities within the shortlisted regions. The water authorities within each shortlisted region from which water price data was obtained are listed in Table B.6 below.

Table B.6: Water authorities in each shortlisted region from which water usage data was obtained

Regional NSW	Metropolitan Victoria	Metropolitan South Australia	Green Triangle
Dubbo Regional Council	Greater Western Water	SA Water	SA Water
Parkes Shire Council	Barwon Water		Wannon Water
Forbes Shire Council			
Riverina Water			

Source: Deloitte Access Economics

To calculate water usage charges for regional NSW, metro VIC and northern Adelaide, an average was taken across the rates published by the corresponding water entities listed in Table B.6. The calculated water usage rates across each shortlisted region used in the model are contained in Table B.7. Total water costs in the model were calculated by multiplying the per-megalitre usage charges by total water usage.

Table B.7: Water usage charge assumptions, $/ML

Regional NSW	Metropolitan Victoria	Metropolitan South Australia	Green Triangle
2,043	2,720	3,035	2,739

Source: Deloitte Access Economics, based on data from local councils and metropolitan water authorities.

6.10.2 Trade waste discharge costs

The cost of discharging scouring effluent to sewer in each shortlisted region was derived by combining data on the chemical composition of scouring effluent, council/water authority charges by contaminant, and contaminant discharge limits.

A representative chemical composition of scouring effluent was obtained from CSIRO research. Effluent composition can vary considerably depending on the quality and type of greasy wool scoured, which in turn is affected by seasonal conditions where wool is grown. No data exists to inform regional scouring chemical estimates, so scouring effluent composition was assumed to remain constant across the shortlisted locations. The quantity of each contaminant in milligrams per litre of effluent is given in Table B.8.

Table B.8: Chemical composition of wool scouring effluent, mg/L

Contaminant	Value
Biochemical Oxygen Demand (BOD)	1,600
Chemical Oxygen Demand (COD)	5,700
Solvent-extractable Matter (SE)	360
Suspended solids (SS)	185
Total Phosphorous (TP)	18
Total Kjeldahl Nitrogen (TKN)	350
Sulfur	-
Nonionic surfactants	45
Total dissolved solids (TDS)	-

Source: Bateup and Christoe (n.d.), *Effluent Management,* CSIRO Division of Wool Technology.

Limits relating to the discharge of specific contaminants are reported by a limited number of water authorities. Limits for biochemical oxygen demand (BOD) are the most reported and ranged from 300 to 1,000 mg BOD/L effluent. Available data on discharge limits is given in Table B.9 below.

Table B.9: Discharge limits reported by councils and water authorities, mg/L

Contaminant	Barwon water	SA Water	Mt Gambier	Dubbo
BOD	500	1,000	1,000	300
COD	1,200	-	-	300
SE	-	-	-	-
SS	500	-	-	300
TP	14	-	-	20
TKN	60	-	-	100
Sulphur	50	-	-	-
Non-ionic surfactants	100	-	-	-
ITDS	-	-	-	-

Source: data published by councils and water authorities

A single effluent discharge cost in $/kg scoured wool was calculated for each shortlisted location. The formula used and explanation of terms is as follows:

$$E = \frac{(C_i - L_i)}{E_d} \times D_i \times \frac{1}{Ws}$$

Where:

- E is the total effluent charge
- C is the quantity in milligrams of contaminant i per litre of effluent
- L is the discharge limit in milligrams of contaminant i per litre of effluent
- E_d is the total effluent discharge in milligrams
- D_i is the discharge cost in $/kg for contaminant i
- W_s is the total amount of scoured wool in kilograms.

The resulting effluent discharge rates (in $/kg scoured wool) are given in Table B.10.

Table B.10: Effluent discharge cost of scoured wool across shortlisted locations, $/kg clean

Regional NSW	Metro VIC	Northern Adelaide	Green Triangle
0.039	0.057	0.016	0.034

Source: Deloitte Access Economics, based on local council and metropolitan water authority data

A limitation of the trade waste discharge costs is that many regional towns and cities within the four shortlisted regions do not report trade waste discharge costs by contaminant type, unlike metropolitan locations, which typically do. The implication is that effluent treatment costs are likely under-estimated in regional locations. This limitation is not assessed as having a material impact on the reported operational costs of a wool scouring facility, since total effluent discharge costs amount to less than $20 million over the lifetime of the facility.

6.10.3 Labour costs

Labour costs were obtained from the ABS 2021 Census.

Wool processing occupations were mapped to Census occupations. The concordance is contained in Table B.11 below.

Table B.11: Financial model and Census occupation concordance

Role area	Model occupation	Census occupation
Production	Production Manager	Production Managers
	Production assistant	Textile and Footwear Production Machine Operators
	Shift supervisors	Other Miscellaneous Technicians and Trades Workers
	Press operators	Textile and Footwear Production Machine Operators
	By-products	Textile and Footwear Production Machine Operators
	Scour operators	Textile and Footwear Production Machine Operators
	Card operators	Textile and Footwear Production Machine Operators
	Preparation operators	Textile and Footwear Production Machine Operators
	Comb operators	Textile and Footwear Production Machine Operators
	Finisher operators	Textile and Footwear Production Machine Operators
	Open Bales	Textile and Footwear Production Machine Operators
Maintenance	Maintenance Coordinator	Other Miscellaneous Technicians and Trades Workers
	Electrical / Mechanic supervisor	Other Miscellaneous Technicians and Trades Workers
	Maintenance / purchase assistant	Metal Fitters and Machinists
	Day mechanics / electricians	Electricians
	Shift mechanic / Electricians	Electricians
	Spare parts leader/Safety Supervisor	Safety Inspectors
	Spare parts shift	Metal Fitters and Machinists
Quality assurance	Quality Assurance Manager	Science Technicians
	ISO coordinator	Other Miscellaneous Technicians and Trades Workers

	Lab supervisor	Science Technicians
	Lab operators on shift	Other Miscellaneous Technicians and Trades Workers
Logistics	Logistics Manager	Supply, Distribution and Procurement Managers
	Warehouse coordinator	Logistics Clerks, nfd
	Forklift drivers on shift	Forklift Drivers
	Admin staff	Clerical and Administrative Workers, nfd
Administration	General Manager	General Managers
	Manufacturing Manager	Production Managers
	HR Manager	Human Resource Managers
	LC Officer	Credit and Loans Officers
	Financial controller	Finance Managers
	General accountant	Accountants

Source: ABS 2021 Census

6.10.4 Consumables costs

Consumables costs were obtained from TechNZ and adjusted to Australian dollars.

Appendix C Implementation

C.1. Commercial Objectives

The key criteria used to assess the delivery options is detailed below.

Table C.1: Commercial Objectives and rating guidance

Criteria	Guidance for 1/3	Guidance for 2/3	Guidance for 3/3
Delivery timeframe (ability to perform to milestones)	Risks not delivering major infrastructure by 2030. Relies on a singular delivery partner to deliver on time	Risks not delivering major infrastructure by 2030. Relies on 1-2 delivery partners to deliver on time	Risks not delivering major infrastructure by 2030. Accommodates multiple partners to deliver on time.
Planning & regulatory environment	Option poorly manages regulatory issues making it less likely the facility will be developed	Option partially manages regulatory issues making it somewhat likely the facility will be developed	Option fully manages regulatory issues making it likely the facility will be developed
Financial impact, cost, and budget certainty	Option does not delivery budget certainty and may require additional government funding	Option delivers budget certainty over some aspects, but not others	Option delivers budget certainty for government
Access to capital	Option reliant on government financing over the long term, delivery and operating model is not self-sustaining	Option allows for some components with access to private capital markets, others reliant on government	Option allows for maximum access to private capital and appeals to investors and can be self-sustaining.
Optimised market capacity and appetite	Relies on private parties to deliver in areas they are not market leaders. Limited local developer market could/would be willing to participate	Harnesses the capacity and capability of the private sector. Maximises the ability to leverage networks to attract target businesses, OR Appeals to the local developer market, and provides the ability for specialist providers to be selected for unique requirements	Harnesses the capacity and capability of the private sector. Maximises the ability to leverage networks to attract target businesses; AND Appeals to the local developer market, and provides the ability for specialist providers to be selected for unique requirements
Construction and market risk	Uncertainty over construction and market risk prevents project from proceeding	Partial uncertainty over construction and market risk delays the project from proceeding	Full certainty of construction and market risk does not prohibit or delay the project from proceeding

Flexibility and control	WPA retains NEITHER: Control over the vision and enabling infrastructure; AND Flexibility to adapt to market needs over time and encourage innovation	WPA retains: Control over the vision and enabling infrastructure; OR Flexibility to adapt to market needs over time and encourage innovation.	WPA retains Control over the vision and enabling infrastructure; AND Flexibility to adapt to market needs over time and encourage innovation.
Product, place value proposition, and innovation	NEITHER: Creates and deliver on the value proposition for industry by attracting and converting opportunities; OR Delivers critical mass and supports and support and stimulates innovation	Creates and deliver on the value proposition for industry by attracting and converting opportunities; OR Delivers critical mass and supports and support and stimulates innovation	Creates and deliver on the value proposition for industry by attracting and converting opportunities; AND Delivers critical mass and supports and support and stimulates innovation
Post Occupancy Service	Maintenance and effective management of the facility fully relies on the on the owner	Some maintenance and effective management facility	Ensures maintenance and effective management of the facility
Exit strategy	Allows government to sell down assets and recycle capital outlay on NO assets	Allows government to sell down assets and recycle capital outlay on SOME assets	Allows government to sell down assets and recycle capital outlay on ALL assets
Scope management	Risk of scope items being missed due to large number of delivery parties across similar scope items	Key scope items are clearly delineated	Clear delineation of responsibilities between each delivery party

C.2. Procurement Package Options and Analysis

Table C.2 highlights the different packaging options that have been identified using the commercial objectives identified in Section 6.2.2, which were then assessed in Chapter 6.

Figure C.1: Packaging options

C.3. Delivery Models for each Procurement Package

For each of the bundles, available delivery models were identified and assessed against the commercial objectives. This is articulated in Table C.2 to Table C.5 below.

Table C.2: Available delivery models for 1. Site Civils and Construction works & 3. Utilities

Delivery Model	Description	Delivery time-frames	Planning and 77egulator or environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
Construct only	Designs are prepared by consultants engaged by or on behalf of the construction agency. Until the entire work is designed, tenders for construction contract are not invited.	2	3	2	2	1	1	3	1	1	2	2	**20**
Design and Construct (D&C)	The construction agency provides a project brief containing some concept design and specifics the performance and quality requirements. The contractors engage consultants to prepare and develop the design and construction documents.	3	3	2	3	3	2	2	3	3	3	2	**29**
Early contractor involveme nt	Where the contractor participates in the design development stage and allows design team to better understand constructability and cost impacts early on.	2	3	2	3	2	1	2	1	1	2	2	**21**

Delivery Model	Description	Delivery time-frames	Planning and 77egulator environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
Alliance	These types of contracts require the involvement of owners, designers, builders, and key stakeholders on a project at the conceptual stage. Both risk and reward are shared by the parties to the contract.	1	1	1	1	1	2	1	2	1	1	1	**13**
PPP	An SPV is formed that designs, finances, delivers, and operates the asset.	1	1	1	1	1	2	1	2	1	1	1	**13**
Design, Develop & Construct		3	3	3	3	3	3	2	2	2	3	3	**30**
Design, Construct, and Maintain (DC&M)	The contractor is provided with a project brief including concept design and the quality and performance requirements of the asset. The contractor is responsible for preparing and developing the concept design, construction documents, asset construction, and maintenance for a specific period.	1	3	3	2	1	3	2	2	3	1	3	**24**

Table C.3: Available Delivery models for 2. Land Procurement

Delivery Model	Description	Delivery time-frames	Planning and 79egulator environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
Put out an open EOI for landowners to offer their land parcels	Government releases an Expression of Interest for landowners to submit their available pieces of land	2	3	3	3	2	3	3	3	3	3	3	**31**
Directly approach landowners with favourable sites which are currently on the market to request their sites	Government approaches landowners who have listed their sites for sale and negotiates the sale of land at market value.	3	2	3	2	2	2	2	2	2	2	2	**24**
Directly approach landowners with favourable sites which are not on the market to request their sites	Government approaches landowners who have not listed their sites for sale and negotiates the sale of land at market value.	1	2	2	2	2	1	1	2	2	2	2	**19**
Freehold purchase; wait for market	Government waits for land required before approaching market and providing an offer	1	2	1	3	1	1	1	3	3	3	3	**22**
Option to purchase	Right to buy land in future for set value today	2	2	3	3	2	3	2	2	3	3	2	**27**
Right to develop on behalf of owner or Joint Venture	Government becomes the developer of private lands on behalf of landowner (or Joint Venture) (ownership depends on terms)	2	1	2	1	1	3	1	1	2	2	2	**18**

Table C.4: Available Delivery models for 4. Specialist Kit Provision

Delivery Model	Description	Delivery time-frames	Planning and regulatory environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
Buy off the shelf equipment, with manufacturer to assemble on site	Equipment is purchased 'off the shelf', and will then be assembled by the manufacturer on site	2	3	3	3	2	3	3	3	3	3	3	**31**
Buy off the shelf equipment, with manufacturer to assemble on site	Equipment is purchased 'off the shelf', and will then be assembled by the manufacturer on site	3	2	3	3	2	2	2	2	2	3	2	**26**
Buy off the shelf equipment, with contractor to assemble on site	Equipment is purchased 'off the shelf', and will then be assembled by the contractor on site	3	2	3	3	1	2	2	2	2	3	2	**25**
Provide specifications to purchase 'bespoke' equipment – manufacturer to assemble on site	Government / engaged consultants provide a project brief containing concept design and specifics on the performance and quality requirements to the manufacturer of the equipment. The manufacturer will then assemble the equipment on site	1	3	2	2	2	2	3	3	2	2	3	**25**
Provide specifications to purchase 'bespoke' equipment – contractor to assemble on site	Government / engaged consultants provide a project brief containing concept design and specifics on the performance and quality requirements to the	1	3	1	2	1	2	3	3	2	1	3	**22**

Delivery Model	Description	Delivery time-frames	Planning and regulatory environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
	manufacturer of the equipment. The contractor will then assemble the equipment on site												

Table C.5: Available Delivery models for 5. Estate Management

Delivery Model	Description	Delivery time-frames	Planning and regulatory environ-ment	Financial impact, cost, and budget certainty	Access to capital	Optimised market capacity and appetite	Const-ruction and market risk	Flexi-bility and control	Product, place, value proposition execution & innovation	Post occup-ancy service	Exit strategy	Scope manage-ment	Score /33
Combined Operate & Maintain	Combined operator and maintainer of assets	3	3	3	2	2	2	2	1	2	3	3	**26**
Separate Operate only & Maintain only	Separate operator of assets, and separate maintainer of assets	3	3	2	2	2	2	2	2	2	2	1	**23**

C.4. Resourcing Plan and Capability Requirements

The two figures below provide high level detail on the different resourcing which would be required to develop the facility.

Figure C.2: Work breakdown structure for the development of a wool processing facility

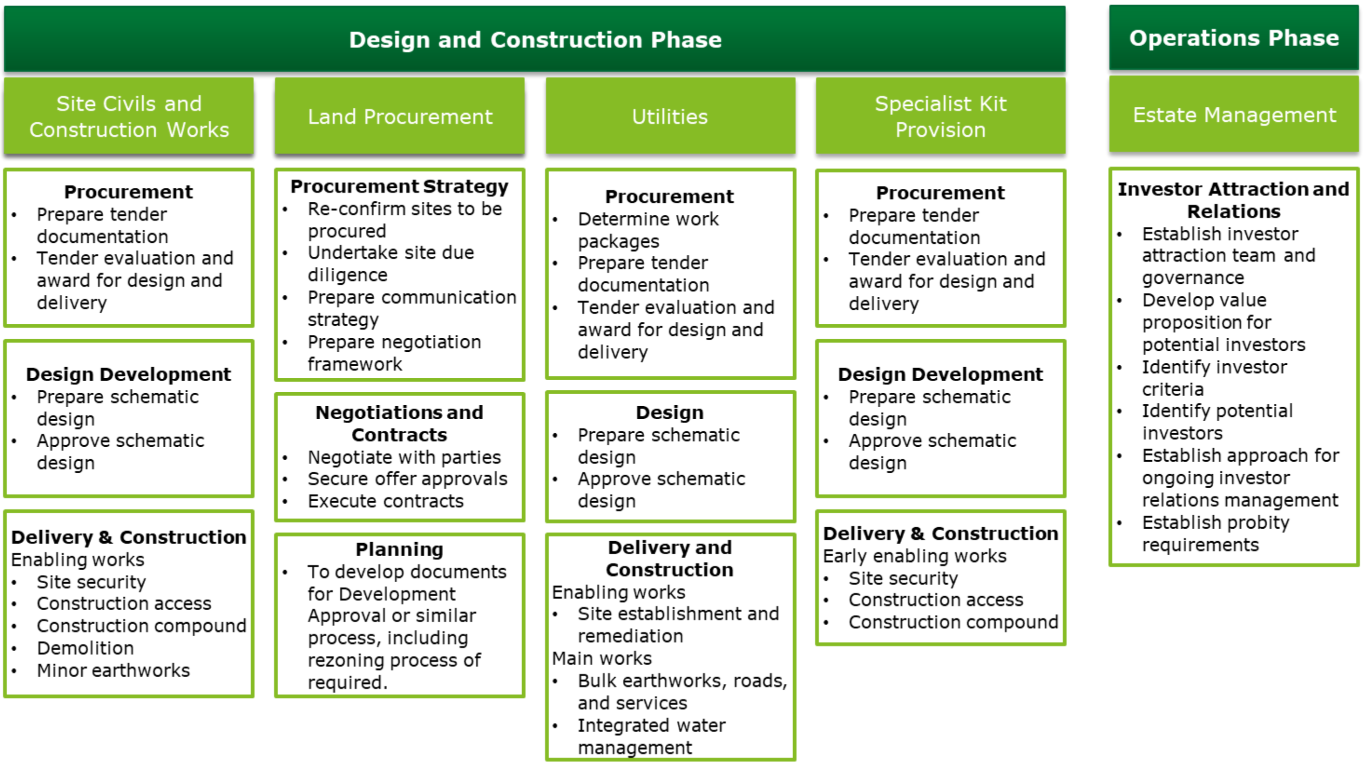
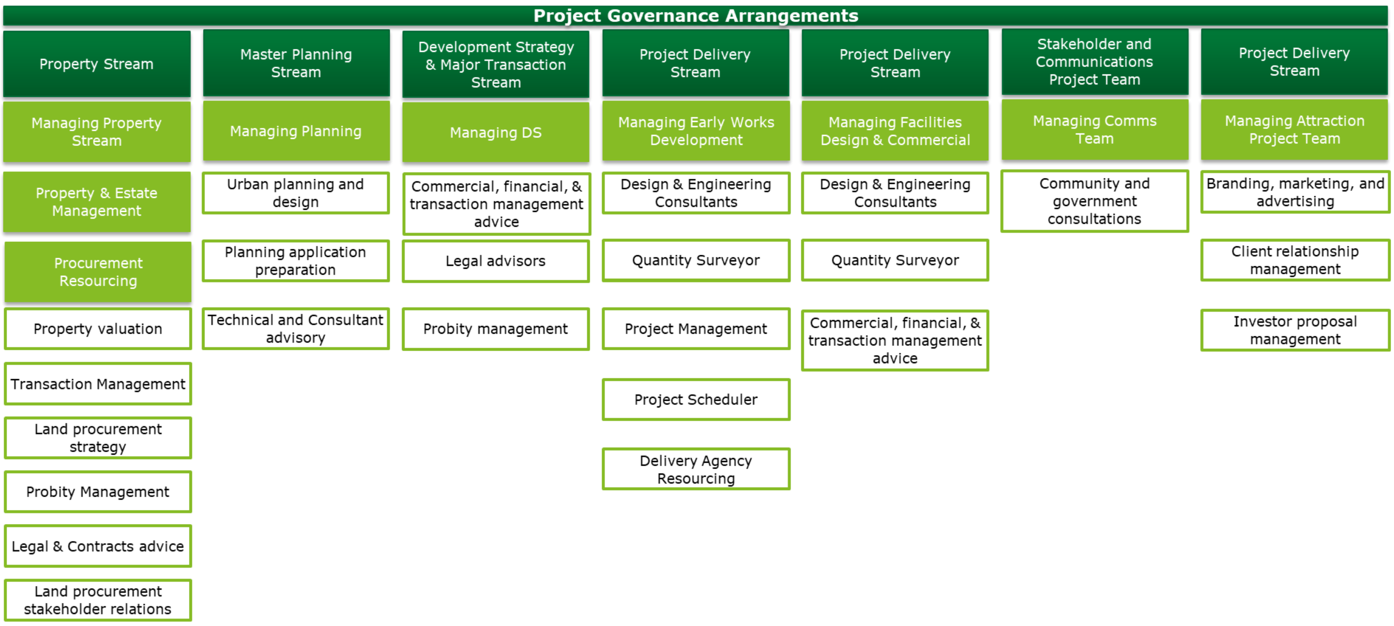


Figure C.3: Capability requirements to deliver a wool processing facility.



C.5. Identified Stakeholders

Table C.6: Stakeholders who have been consulted to date

Key stakeholders (internal and external) that will be affected	Relationship to the proposal	State the consultation already undertaken and the role that they played in determining and endorsing the preferred option	Identify how stakeholder issues have been integrated into the service scope or why they have not been included	Provide an overview of the likely impact of the preferred option on key stakeholders, and outline their position in relation to the project	Identify how the relevant issues will be managed
WPA Steering Committee	Expert industry guidance	Participated in workshops and provided feedback	Not included	No major impact	Virtual meeting with affected stakeholder(s) and WPA
Australian Wool Handlers	Wool logistics expert guidance	Provided logistics advice via email	Not included	No major impact	Virtual meeting with affected stakeholder(s) and WPA
Dubbo Regional Council	Local Government authority	Provided development-specific regulatory advice via virtual consultation	1c) Location-specific regulatory barriers and costs	No major impact	Virtual meeting with affected stakeholder(s) and WPA
Greater Western Water	Local water authority	Provided indicative trade waste discharge costs for financial appraisal	Not included	No major impact	Virtual meeting with affected stakeholder(s) and WPA
SA Water	Local water authority	Provided advice on water quality and trade waste discharge costs for financial appraisal	Not included	No major impact	Virtual meeting with affected stakeholder(s) and WPA
NSW Government Department of Planning and Environment	State Government planning authority	Provided advice on water and trade waste discharge regulations for large industrial facilities	1c) Location-specific regulatory barriers and costs	No major impact	Virtual meeting with Government authority and WPA

Table C.7: Stakeholders who will be consulted in the next phase of the project

Potential Stakeholders	Relevant Contact (if known)
Federal Government	
Department of Agriculture, Fisheries, and Forestry	
Agricultural Forecasting and Trade	Kurt Hockney (Division Head)
Agricultural Labour Taskforce	Craig Rosner-Moore (Division Head)
Strategic Policy	Cathryn Geiger (Division Head)
Department of Climate Change, Energy, the Environment and Water	
Environmental Assessments NSW and ACT	Kate Gowland
Environmental Assessments Vic and Tas	Rachel Short
Strategic Partnerships	Gaia Puleston
Department of Industry, Science and Resources	
Sovereign capability and supply chains	Donna Looney (Division head) Tim Wong (Office of supply chain resilience)
Industry growth	Deb Anton (Division head) James Flick (Industrial NetZero Policy) Louise Talbot (Sector Development)
National Reconstruction Fund	Newly announced board Rebecca Manen (Division Head)
Modern Manufacturing Initiative (closed)	
Department of the Treasury	
Labour Market, Environment, Industry, and Infrastructure Division	Mohita Zaheed (First Assistant Secretary)
State Government - Victoria	
Department of Energy, Environment, and Climate Action	
Department of Jobs, Skills, Industry, and Regions	
Department of Treasury and Finance	
State Government – NSW	
Department of Planning and Environment	
Department of Enterprise, Investment and Trade	

Appendix D Policy response summary

This appendix provides an overview of the policy responses being pursued in Phase 2 of WPA's ATMAC funded project to develop pathways for domestic and diversified early-stage wool processing. In particular this appendix summarises recommendations and actions for industry and government from that were developed in roadmaps for specific international markets of:

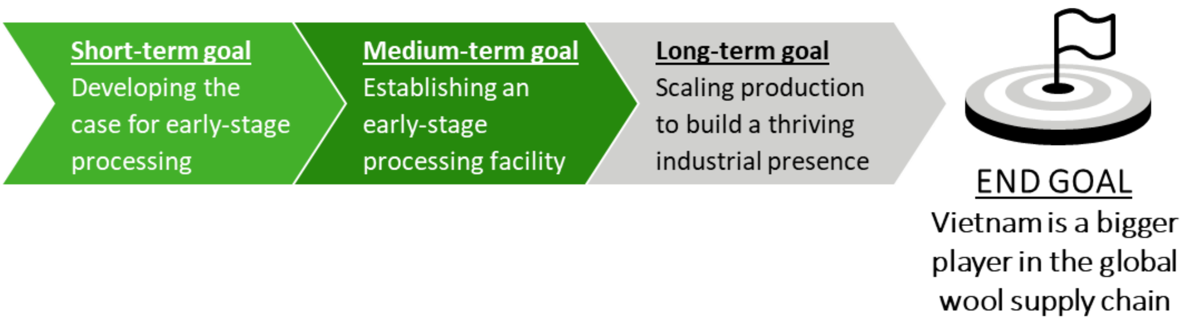
- Vietnam
- India
- Bangladesh.

The framework for developed recommendations covers short-, medium- and long-terms goals to support international markets becoming larger players in the global wool supply chain. To achieve these goals, it is important that the manufacturing ecosystem, and the supporting institutions work together to implement the recommendations support these goals.

The development of the framework underpinning the roadmap and its recommendations considers the current state of wool trade between with Australia and other markets, the current strengths and challenges (or 'weakness'), as well as opportunities and threats facing the wool industry around the world. The framework has benefitted from the views, insights and feedback from many industry and government stakeholders in Australia and overseas locations.

D.1. Vietnam road map

Figure D.1: Framework underpinning Vietnam roadmap recommendations



D.1.2. In Vietnam, the short to medium term, Vietnam would benefit from strategies that provide it with 'quick wins' – including by establishing large scale early-stage processing facilities.

- Vietnam (particularly downstream processors and manufacturers) would benefit from establishing its first early-stage wool processing facility.
- Encourage Vietnamese wool processing firms to **continue to develop cases for an early-stage processing** facility in Vietnam, particularly targeted at multi-national early-stage processors for potential partnership. Securing customer commitments or offtake agreements will strengthen the case for relocating capacity and reduce project risk.
- Ecosystem enablers (e.g., Government of Vietnam, Vietnam Textile and Apparel Association) can establish the conditions and to design policies that can attract early-stage processors to relocate their operators into Vietnam. Dedicated Australian trade facilitation resources, particularly with an understanding of the local market, could complement these investment attraction initiatives.

D.1.2.1.Developing the case for early-stage processing

Information gathering and market scan.

Industry and government can build on the information provided as part of this roadmap to identify the most commercially viable and strategically appropriate development of early-stage wool processing in Vietnam.

Further research and market intelligence may be required on the downstream markets for the expansion of Vietnam-based early-stage processing. This research could examine the market segmentation across intermediate product types (e.g., yarn products) and final product demands (e.g., garments versus technical uses).

Feasibility study of possible locations for early-stage processing in Vietnam.

Regardless of the configuration of processing to be established in Vietnam (wet and dry or dry-only), a feasibility study should be conducted to determine the location of a potential facility. This roadmap has identified the factors influencing the location of such a facility, including proximity to downstream demand and infrastructure availability. This roadmap has not conducted detailed analysis of a particular facility type at a particular location, which will be required for a conclusion of feasibility.

Such a feasibility study would include information on:

- Configuration of the early-stage processing facility.
- Where the new early-stage processing facility will be located.
- What products will be produced at the facility, and an assessment of the market for these products.
- What type of wool will be required.

Addressing barriers to establishment of new capacity.

Foreign-based processors should use the information gathered during the feasibility study and market scan to explore technical barriers to separating wet and dry processing as well as continue to engage VITAS to maintain familiarity with wool fibres and benefits in the Vietnamese market. At the same time, the Government should continue to invest in building and maintaining Vietnam's port and road infrastructure.

Stakeholders remarked that it is difficult for a foreign-invested company to obtain a wastewater discharge permit. Early-stage processors could partner with an existing firm who already has a wastewater discharge permit or choose to locate an early-stage processing facility within an industrial park.

The Australian Government could also play a role in encouraging partners based in Vietnam to adopt Australian wool. It should work together with firms to increase general awareness and adoption of wool (especially Australian wool) in Vietnam through a marketing campaign. Such a marketing campaign could continue to address the misconception that wool is used for winter wear only and highlight the 'natural advantages' of Australian wool.

Continue to encourage the development and growth of downstream spinning, weaving and garment making

In the short-term, the Vietnamese Government should continue to encourage the development of current downstream wool and garment manufacturing capabilities and continued growth of these sectors driven by foreign investment. This will only strengthen the case for upstream early-stage processing to be established in Vietnam. Therefore, government and relevant industry bodies should:

- Provide support for firms as they seek to implement some of the action points:
    - This could take the form of government funding, or industry bodies helping to connect firms with other firms or people with the needed expertise.
    - Ensure that local vocational colleges have programs and courses relevant for the wool manufacturing industry.
- Work together to formulate a longer-term vision for the wool manufacturing industry, noting that the current textile industry development strategy is outlined to 2030, with a vision to 2035. This can give stakeholders greater certainty of where the wider industry is heading.
    - As part of the updated development strategy, there should be specific action plans and recommendation outlined for various textile products, including wool.
- Role for VITAS in acting as a liaison between industry and government – to communicate the views of industry to obtain better government outcomes.

D.1.2.2.Establishing an early-stage processing facility

In the medium term, with the case for establishing early-stage processing firmly understood, Vietnam's first early-stage processing facility could be established and built.

Many of the activities and actions at this stage will be driven by commercial decisions of processors and their partners. Where the Australian or Vietnamese governments see a case for accelerating the development of this supply chain, government support could facilitate the establishment a 'pilot' early-stage processing facility, to provide a 'proof of concept' and eventually a catalyst for other early-stage processing firms to relocate their operations into Vietnam.

The findings of this roadmap and of an assessment of the current global wool market today indicate that the relocation of existing capacity to Vietnam would be the most likely pathway.

There would be at least a 1- to 2-year lead time to secure permits and approvals if the facility were to be located within an industrial park. Locating near a downstream processor (e.g., a spinning facility) would lessen the training requirements for staff.

D.1.3. In the long-run, a deliberate set of strategies will be needed to ensure sustainability – including by scaling production to build a thriving industrial presence.

- The action of a few firms relocating their supply chain can act as a catalyst for other firms located throughout the value chain to follow suit.
- Australian and Vietnamese Governments can continue to monitor and evaluate their performance against existing strategies to encourage trade and complementary industry development, including in wool.
- In Vietnam, this will also involve monitoring whether the shift of textile and clothing production capabilities continues, and to implement policies to support continued growth observed in the textile industry.

D.1.3.1. Long-term: Scaling production to build a thriving industrial presence

Beyond the establishment of Vietnam's first early-stage processing facility, a range of long-term opportunities for action can help to continue to grow the wool supply chain and increase trade and investment between Australia and Vietnam.

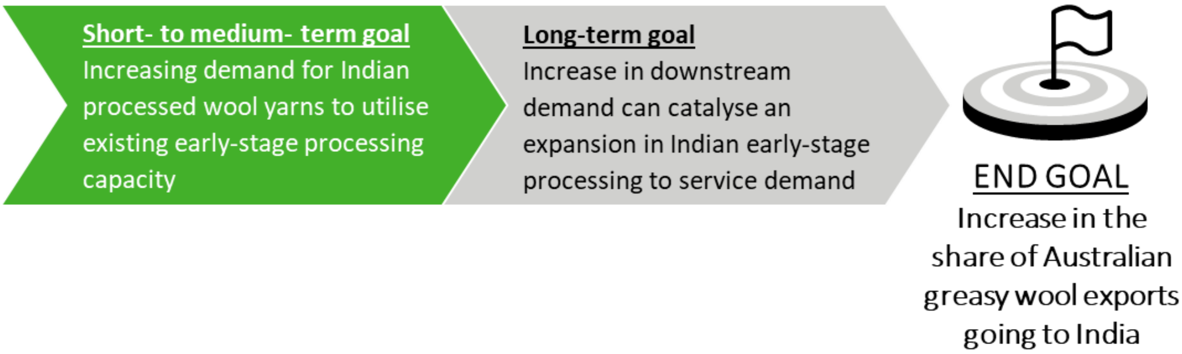
Table D.1: Long-term opportunities to build a thriving industrial presence

Recommendation	Description	Industry and industry bodies	Vietnamese Government	Australian Government
Taking action to encourage final demand for wool-based products	Ultimately the capacity of the early-stage processing sector is linked to the final demand for wool-based products (both within Vietnam and overseas). Further research, strategies and policies, across the Australian Government and the wool producing industry will be important to ensure that demand for wool-based products continue to grow. Innovation from firms in product development and marketing is also an important component of this, diversifying the categories of products and breaking down preconceptions of wool uses.	X		X
Continued cooperation on trade and investment between Australia and Vietnam	The Australian and Vietnamese Governments should continue to work together to lower barriers to trade and investment between Australia and Vietnam.		X	X
Invest in building the capabilities and skills level of its workforce	Continued long-term investment in labour and skills development of all staff can build a better working culture. This can result in better business outcomes for firms (e.g.,	X	X	X (Facilitating collaboration with educational institutions)

	managers and sales representatives having a deep level of knowledge of wool products, the manufacturing process and the trends impacting the sector is useful when seeking to negotiate with suppliers) and lift sectoral productivity. To achieve these aims: • Processors should develop a structured on-the-job training program that includes a stint in an established manufacturing facility overseas to learn best practice. • Vocational colleges could offer relevant courses and diplomas that can enable workers to upskill themselves.			
Build understanding of the sustainability credentials of wool in the Vietnam market	Downstream firms and consumers, particularly those in Europe, are placing a greater importance on sustainability before making purchasing decisions. The Government of Vietnam has also identified the role of sustainable fibres in achieving their long-term textile industry development strategies. There is an opportunity for Australian wool, leveraging its 'natural' advantage of being renewable, recyclable and biodegradable, to appeal to processors as it seeks to source inputs that are more environmentally friendly.	X		X
Regularly monitor and evaluate performance against roadmap	Regularly review and update the roadmap based on changing market dynamics, trade policies, and emerging opportunities. The Vietnamese Government and industry bodies should ensure that updates to the roadmap are aligned to the sentiment of local textile processors and address their willingness to further expand and grow their upstream processing activities.	X	X	X

D.2. India road map

Figure D.2: Framework underpinning India roadmap recommendations



D.2.2. Short to medium-term recommendations

In the short- to medium-term, the primary goal should be to increase the utilisation of existing early-stage processing capacity in India. Until this capacity is filled, firms are unlikely to make any additional investment as there is insufficient market demand.

Most of this capacity is integrated with spinning activities, and so **increasing demand for India's wool yarns** would send the necessary market signals. Achieving this will require India to undertake strategies and actions that grow its reputation and attractiveness as a global supplier of wool yarns.

Recommendation 1: Conduct further market research of the market dynamics of the downstream Indian textile and apparel industry, including in areas such as understanding drivers of demand for Indian processed wool yarns sold to export markets.

This research should engage deeply with the Indian wool industry and with the global customers of Indian products. This applies especially to the downstream distribution and marketing stages of the chain that are closest to the consumers. These stages can both reflect and influence consumer purchasing behaviour but are also the most remote from wool production itself, and hence have the most to learn about wool. Key questions to address include:

- The drivers of demand for Indian produced wool yarns sold in export markets.
- Identifying sources of quality control issues in Indian processed wool products (particularly yarns) and implementing solutions to address them.
- Working with apparel brands to understand the drivers of their sourcing decisions as well as promoting the use of Indian produced yarns in their products.
- How Australian industry can work collaboratively with Indian industry to improve the domestic marketing of wool in India.

Recommendation 2: Grow India's profile as a sourcing destination for wool products including yarns and final products such as garments.

Australian greasy wool potentially has a significant role in meeting increased demand from India as it expands its presence in the global textiles market. Increased market awareness of the benefits of Australian wool can help to drive alternative sourcing decisions.

This role should be focused on joining with the Indian wool industry and its customers based on selling Indian wool products made from Australian wool. Woolmark has previously conducted similar campaigns and this work should be expanded to further develop the Indian market.

Recommendation 3: Establish industry-industry and industry-government relations between Australia and India to foster technical knowledge transfer and ensure customer needs can be met, which could be achieved by enhancing Australia's on-the-ground presence in India.

This initiative will capitalise on and complement recent activity following the ratification of ECTA as well as the establishment of the Joint India Australia Wool Working Group. It should include regular and ever-deepening contact between the Australian and Indian industries. A refreshed Memorandum of Understanding may be required as a binding architecture to convene meetings. Australian Government support would also be a key means of ensuring that the ECTA results in significant trade and cooperation gains. Activities should include:

- Joint trade promotions and study tours.
- Conferences based in India and Australia including key downstream stakeholders to exchange information on the advantages of wool, projections of demand and supply, capacity and investment.
- Understanding the extent to which Australian wool brokers and exporters face any specific market access barriers that are restricting wool trade between Australia and India.
- Joint development of educational and other resources to support wool use.

Whilst the engagement process needs to include stakeholders from across the value chain, it should be led and coordinated by wool producers in Australia. This will ensure that the focus of the initiative remains on generating increased sales and profits for wool growers. Nonetheless, Australia should increase its on-the-ground trade facilitation and government-level presence in India.

D.2.3. Long-term recommendations

In the long run, achieving market diversification of Australian wool will require growing India's share of Australian wool exports. Achieving the short- to medium-term recommendations set out in Section D.2.2 will help to ensure downstream demand is adequate to warrant an expansion of early-stage processing capacity and therefore boost India's demand for greasy wool. Increased downstream demand (e.g., via yarn exports) may also create markets for Australian-processed wool products in India. However, this outcome would be contingent on a suitable industry being developed in Australia.

Achieving greater industry scale can help to address issues currently associated with the Indian industry. For example, larger scale can allow for greater amounts of stock to be kept on hand, meaning manufacturers can reduce lead times for incorporating wool into customer orders. This is a key competitive aspect for fashion suppliers who operate on tight timeframes.

Recommendation 4: Support conditions for existing early-stage processors to expand capacity and, where demand for wool-based products increases, potentially encourage new entrants to establish new capacity.

To ensure that early-stage processing capacity can successfully scale, it is important that any barriers to expansion are considered and addressed. These considerations may include:

- Reviewing wastewater regulations and management approaches.
- Reducing barriers to trade, particularly non-tariff measures.
- Ensuring that the local workforce has the appropriate skillset to service the increase in demand and can adapt to changing global wool trends.
- Incorporating technology and embarking on product and process innovation to increase efficiencies, which can make India's products more price competitive.

Recommendation 5: Investors considering entering the India market should identify priority states for further research and consider strategic partnerships with on-the-ground partners to navigate the complex business and regulatory environment.

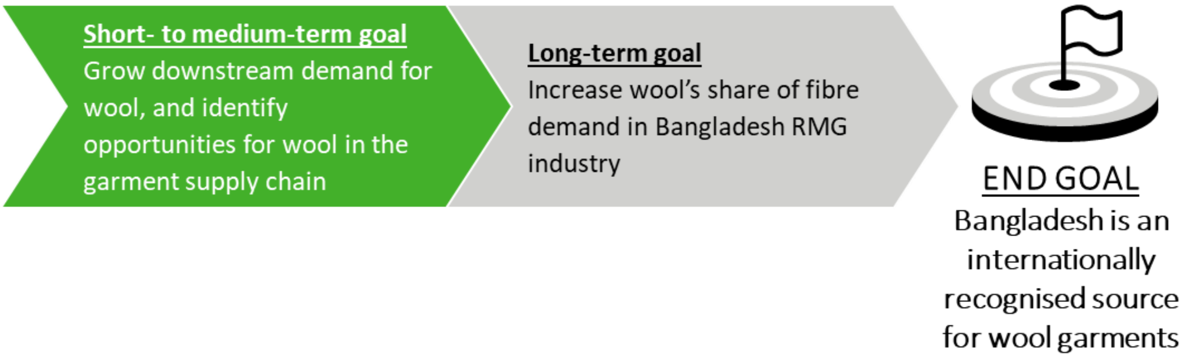
India is a complex market where business conditions and regulatory requirements can vary considerably between states. If demand for Indian wool products has grown in the future such that investors are considering establishing new early stage processing capacity or relocating machinery from elsewhere, they should consider doing this as a joint venture with a local partner who can bring local expertise on India's operating environment, particularly its regulatory structure. This may be more easily achieved in states where processers are already located, including Maharashtra, Punjab and West Bengal.

Recommendation 6: If Australia establishes cost-competitive early-stage processing capacity, identify opportunities to sell into Indian yarn spinning markets.

Australia has historically represented 50% of India's top imports. If Australia successfully and economically established expanded early-stage processing of its own, India should be viewed as a potential customer for carded and combed wool tops. This could integrate rapidly with India's existing spinning capability and sold on for export to other markets.

D.3. Bangladesh road map

Figure D.3: Framework underpinning Bangladesh roadmap recommendations



D.3.2. Short to medium-term recommendations

In the short- to medium-term, the primary goal should be to implement measures to increase the adoption of wool throughout the apparel and textile supply chain in Bangladesh, primarily by increasing downstream demand. In part, this can be achieved through increasing their knowledge of and exposure to woollen products.

Recommendation 1: Demonstrate to Bangladesh garment industry the case for change on the market opportunity for wool.

- The wool industry should invest invest in increasing familiarity and understanding of wool within Bangladesh. This could be achieved through a public market research report on the potential opportunities for wool in the garment supply chain, including its uses and benefits. This report could also analyse the impact of incorporating wool would have on firm profitability.
- This provides a role for Australian industry to develop a platform to promote merino wool and build new connections with downstream suppliers in Bangladesh.

Recommendation 2: Encourage uptake and integration of wool into existing cotton and synthetic spinning operations.

- Establish an in-country representative to facilitate wool-related market connections and grow general understanding of wool products in the Bangladesh textile and apparel manufacturing industries. Regular market connections can help increase manufacturer's awareness of the uses of wool, and how to integrate it into the supply chain, particularly the uses of wool as a fibre.
    - As a first step, this could include collaboration between Australian wool processors and Bangladesh cotton and synthetic spinners on how wool could be blended into these products.
- A technical feasibility study, investigating the degree to which existing machinery could be repurposed to process wool should be conducted initially.

Recommendation 3: Increase demand for Bangladesh wool-based garments and products among procurement buyers and brands

- Market relationships should also be targeted towards the major brands and other buyers of Bangladesh apparel products. These purchasing decisions ultimately determine the product mix, and greater market connections can help develop awareness of Bangladesh as a supplier of woollen goods.
- Ensuring strong wool-related market connections between buyers and brands of Bangladesh's
- wool-based product exports can:
    - Help facilitate the transfer of knowledge and technology.
    - Lead to greater understanding and clarity for existing cotton and synthetics textile operators to adapt their operations to handle wool.
    - Help to grow final demand for wool and increase Bangladesh's wool garment export market share.

Recommendation 4: Encourage supply chain diversification among incumbent wool knitters and garment makers based in India

- Connections should also be established with overseas based brands, particularly in countries such as India and Vietnam that can supply the intermediate yarn and fabrics.

D.3.3. Long-term recommendations

Increasing wool's market share of Bangladesh's textile and apparel supply chains will rely on the willingness and ability of the downstream components of the supply chain to purchase from these new sources. The next step for Bangladesh is to implement measures that can supply the wool inputs needed meet the increased demand. Given the presence of existing downstream components of the supply chain, increasing the amount (and share) of wool in fibre can feed through to the larger RMG industry and help Bangladesh reach its end goal of becoming an internationally recognised source of woollen garments.

Recommendation 5: Develop the case for wool spinning capacity to be established in Bangladesh.

If wool garment production were to increase, this would improve the commercial case to develop its supplying industry - woollen yarn spinning. Wool could also be incorporated into existing cotton and synthetic spinning for blended yarns. This would help reduce dependency on imported yarns and reduce product waiting times for manufacturers.

Establishing wool spinning would require identifying commercial partnerships to provide wool tops to Bangladesh spinners. These products could be sourced from neighbouring countries such as India and Vietnam, who may increase their production capacity of tops in the future. Increasing demand for wool tops in these countries would ultimately diversify demand for Australian greasy wool.

Recommendation 6: Foster a conducive business environment to encourage the establishment of more firms willing to process wool, including reviewing regulations, negotiating free trade agreements and building skills.

it is important that any barriers to expansion are considered and addressed so as to encourage both the relocation of existing wool processing capabilities outside of Bangladesh to relocate into the country and to encourage existing cotton and synthetics lines to handle wool. These considerations may include:

- Reviewing wastewater regulations and management approaches.
- Signing FTAs with countries that are the sources of intermediate inputs (e.g., Vietnam and India) and sources of final demand.
- Ensuring that the local workforce has the appropriate skillset to incorporate of wool in the supply chain and can adapt to changing global wool trends.
- Incorporating technology and embarking on product and process innovation to increase efficiencies, which can make Bangladesh's garment products more price competitive.
- Expand and promote the use of Special Economic Zone that specialise in textiles, which could increase the attractiveness of wool processing, enticing firms to shift their facilities to Bangladesh.
- Government incentives which can help existing cotton and synthetic textile operators to purchase the machines needed to handle wool.
- Should Australia and/or Bangladesh develop top making facilities, there could be an opportunity for Australia to be a direct supplier for the Bangladesh textile industry.

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