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Ensuring a sustainable future for Australia's wool supply chain

WoolProducers Australia

November 2022

Deloitte Access Economics

Foreword from WoolProducers

The world that we live in is changing at an ever-increasing pace. Our capacity to manage threats and embrace opportunities as they emerge will ultimately determine the long-term sustainability of our industry.

The wool supply chain from farm to fashion is perhaps one of the longest supply chains in the agriculture sector. Over time, the global wool production and processing sectors have evolved to become the complex ecosystem that we know today.

Pressures on our industry, including a shrinking national wool clip and increasing energy and labour costs, resulted in the offshoring of much of Australia's wool processing capacity throughout the 1990s-2000s, to a point where we now only have sovereign capacity for early-stage processing of approximately 5% of the wool that we produce. The remaining 95% of our wool production is reliant on early-stage processing in a small number of countries before it can be used in the global textile supply chain. This concentrated reliance, together with emerging threats of sanitary and phytosanitary risks; other non-tariff trade barriers; and pressures on international sea freight costs and capacity present tangible risks to the Australian wool industry.

WoolProducers Australia invested significant resources to brief members of the Australian Parliament of all persuasions on the risks our industry faces. Through the Agricultural Trade and Market Access Cooperation (ATMAC) Program, administered by the Department of Agriculture, Fisheries and Forestry (DAFF), WoolProducers was awarded a grant to undertake a feasibility assessment of domestic and diversified early-stage wool processing and determine its trade risk mitigation benefits.

This report is the product of genuine industry collaboration throughout the inception, planning and delivery phases of this project. I would like to specifically acknowledge the contributions from David Michell and the late Steven Read of Michell Wool. Their extensive contributions of technical knowledge and introductions to relevant industry members have undoubtedly assisted in producing this high calibre, comprehensive report.

The report sets out the next steps that we as an industry can take to improve the long-term sustainability of our industry. Through ongoing genuine collaboration, I am confident that the Australian wool industry has a sustainable and prosperous future in continuing to supply global consumers with the most sustainable fibre in the world.

Ed Storey,

President – WoolProducers Australia

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Acronym	Full name
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABS	Australian Bureau of Statistics
ACWEP	Australian Council of Wool Exporters & Processors
APTA	Asia Pacific Trade Agreement
ASEAN	Association of Southeast Asian Nations
AWI	Australian Wool Innovation
AWEX	Australian Wool Exchange
AWTA	Australian Wool Testing Authority
CAGR	Compound annual growth rate
CEAP	Circular Economy Action Plan
CECA	Comprehensive Economic Cooperation Agreement
CGE	Computable general equilibrium
ChAFTA	China-Australia Free Trade Agreement
CO_2	Carbon dioxide
COO	Certificate of Origin
CPI	Consumer Price Index
CPO	Chief Procurement Officers
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAE-RGEM	Deloitte Access Economics Regional General Equilibrium Model
DAFF	Department of Agriculture, Fisheries and Forestry
DALRRD	Department of Agriculture, Land Reform and Rural Development
DFAT	Department of Foreign Affairs and Trade
EAD	Emergency animal disease
EBITDA	Earnings before interest, taxes, depreciation, and amortization
EU	European Union
FAO	Food and Agriculture Organisation
FDI	Foreign direct investment
FMD	Foot-and-mouth disease
FTA	Free trade agreement
FTE	Full-time equivalent
GDP	Gross Domestic Product
GNI	Gross national income
IA-CEPA	Indonesia-Australia Comprehensive Economic Partnership Agreement
IA-ECTA	Australia-India Economic Cooperation and Trade Agreement
LDC	Least Developing Country
ILO	International Labour Organization
IWTO	International Wool Textile Organisation

KAFTA	Korean-Australia Free Trade Agreement
LCOE	Levelised cost of electricity
MFN	Most Favoured Nation
NCWSBA	National Council of Wool Selling Brokers of Australia
NTM	Non-tariff measure
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PV	Photovoltaics
RMG	Ready Made Garments
SME	Small and medium enterprise
SPS	Sanitary and phytosanitary measures
TBT	Technical barriers to trade
TES	Thermal energy storage
TIFA	Trade and Investment Framework Arrangement
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
WOAH	World Organisation for Animal Health
WPA	WoolProducers Australia
WTO	World Trade Organization

Executive summary

Wool has always been a part of the human story, but wool in the modern world is fundamentally an Australian story. Thanks to the Merino sheep, Australian wool generates $3.6 billion in export income and accounts for approximately 84% of the global superfine wool supply. Now in the beginning decades of the 21st century, in a fully globalised landscape, with looming challenges of climate change and post-pandemic supply chain issues, the wool industry faces significant emerging risks.

Key takeaways

- The Australian wool industry exports most of its production in unprocessed form to China. Market concentration exposes the industry to significant risks from animal disease events, trade disruptions and geopolitical tensions.
- With the current wool supply chain, an outbreak of foot and mouth disease (FMD) would result in a significant reduction in greasy wool exports which would reduce wool industry output by $1.2 billion on average for each year affected. The imposition of tariffs or non-tariff measures (NTMs) from Australia's major trading partner is expected to lead to similar outcomes.
- These risks could be significantly mitigated if Australian wool, which is currently exported in an unprocessed 'greasy' form could be processed in Australia. In the FMD example, a well-established wool processing industry in Australia could reduce the downside risk by over 70%.
- Detailed modelling shows that Australia could deliver processed wool, particularly scoured wool, at internationally competitive rates when comparing operating costs. However, the capital investment required is significant with payback periods likely to be commercially unappealing.
- Expanding early-stage processing capacity in Australia to process 170 million kilograms a year could add up to $1.3 billion to wool industry output and $1.8 billion in GDP for Australia each year. This is in addition to the risk reduction described above.
- Target markets for Australian processed wool would include India, Vietnam, Bangladesh and Indonesia. Although these markets have strong textile sectors, their primary focus is on synthetic fibres and cotton with little wool production. There would be a need to develop wool processing industries and relevant skills in these target countries in partnership with local actors.
- Critical knowledge gaps still exist on the priority countries identified and global wool textile and clothing industry dynamics, with a particular emphasis on industry relocation and structure. More work is required in these areas as this will influence the markets to be targeted. This report recommends the undertaking of two separate business cases to provide an evidence base to consider potential government intervention, based on an assessment of the likelihood of risks, and the economic and social benefits that may result.

THE AUSTRALIAN WOOL SUPPLY CHAIN

Total wool export income

$3.6 billion

In 2021-22

5% Share of processed wool in total wool exports

DOMESTIC EARLY-STAGE PROCESSING COULD MITIGATE EMERGING RISKS

A foot-and-mouth disease outbreak could potentially reduce wool industry output by:

$2.1 billion per year

With the **current** supply chain

$953 million per year

With **greater** domestic processing

$1.1 billion

Potential risk mitigated through expanded early-stage processing, per year

ECONOMIC IMPACT OF EXPANDED EARLY-STAGE PROCESSING

$1.8 billion increase in GDP

582 additional FTEs by 2050

$1.1 billion in capital costs

6-14 number of additional plants required

Historically one of the country's leading exports, wool remains a flagship Australian product. Prized for the properties that made it valuable thousands of years ago, wool provides wind, water, and UV protection, it is antibacterial, and it thermoregulates so effectively that it keeps desert-dwellers cool and inhabitants of the far north warm. Even with the advent of synthetics in the 20th century, wool's remarkable fibres, which evolved over millennia to protect sheep from extreme weather, have unique chemical and physical properties. Their complicated structure means they readily take up and hold colourful dyestuffs, are stain and odour-resistant, require less cleaning, and recover well from wrinkling. Australia's merino sheep, first introduced in 1797 and crossbred intensively in the late 19th century, have perfected wool's ancient properties. Merino wool is used across the world in fine gauge, worsted-spun fabrics that are both timeless and high-tech, ranging from high quality business suits to ultra-lightweight performance wear, and a wide variety of apparel, including baby clothes, t-shirts, and dresses.

Unlike other Australian commodities, whose top export markets each represent 20% to 35% of total exports, virtually all Australian wool is exported, with the overwhelming majority sent to China. Most wool is exported in its unprocessed, or "greasy" form. Effectively, wool that is straight off the sheep's back. Processing generally takes place after export, making wool a uniquely non-perishable agricultural product.

The current state of the wool industry has been shaped by historic policy settings and recent global trends. The last 20 to 30 years has seen Australia's flock shrink by 40%, Australian sheep farmers decline at a similar rate, and wool production be reduced by two-thirds. Prior to this, approximately half of Australian wool was exported to China and half elsewhere. Likewise, in the 1990s, half of the Australian wool clip was cleaned domestically, and half was exported unprocessed. At the time, the wool processing industry relied on significant Government subsidies. The removal of these, alongside the rising competitiveness of China, meant most processing moved offshore and now largely takes place in China. Of the fifteen Australian companies that carried out early-stage processing of wool in the early 2000s, three remain. Those three companies processed just 5.2% of the value of Australian wool exported in the three years to 2021-22.

The recent convergence of the wool supply chain has been an efficient and largely positive evolution. Wool is costly to farm and process, and as a 'natural' product, its processing yield can vary significantly, depending on climate, geography, genetics, and other factors. In the last thirty years, the capital costs of wool production have risen, even as its revenue ceiling has not. Yet in the same period, as Australia's wool trade became focused on the greasy trade to China, the unit price of Australian wool doubled. Indeed, Deloitte Access Economics found a wide consensus that this transformation held the industry together in the 1990s and early 2000s.

However, in the wake of significant recent global supply chain disruption and growing animal disease risks, concerns about the concentration of the Australian wool market are growing. Because most wool is exported as greasy trade to a single destination, it has significant exposure to global market risks, including outbreaks of infectious disease and geopolitical shifts with the sudden imposition of tariffs or other regulatory controls on trade.

WoolProducers Australia is currently exploring the extent to which reintroducing early-stage processing to Australia would benefit the industry and mitigate those risks. Deloitte Access Economics was engaged to carry out an economic analysis of wool processing in Australia. Some of the key questions the research sought to answer include:

- Can early-stage processing be expanded in Australia?
- What are the barriers and benefits?
- Who would buy processed Australian wool?
- What are the larger challenges of processing wool domestically?

Several stages of work were completed to answer these questions, including:

- The identification and assessment of priority international locations with the potential to diversify wool export trade

- A high-level economic analysis to benchmark the cost of domestic early-stage wool processing with these international locations, and whether this would be cost competitive with the current supply chain
- A trade risk scenario analysis to explore the impact of a potential animal disease event and changes to tariff and non-tariff barriers
- Modelling of the economic impact of expanding early-stage processing in Australia

The project included a Steering Committee with members covering the wool supply chain including WoolProducers Australia (WPA), Australian Wool Innovation (AWI), the National Council of Wool Selling Brokers of Australia (NCWSBA), the Australian Council of Wool Exporters & Processors (ACWEP), the Australian Wool Testing Authority (AWTA) and the Australian Wool Exchange (AWEX). The Steering Committee provided expert views on current processing capacity, recent trends and opinions on future potential growth.

Deloitte Access Economics found many opportunities for expansion and identified several barriers. Fundamentally, demand-driven early-stage processing could be reintroduced to Australia but may require significant capital subsidy. Numerous countries present market opportunities, particularly India, Vietnam, Bangladesh and Indonesia. The cost of expansion is not prohibitive and could add up to $1.3 billion to wool industry output and $1.8 billion in GDP by 2050, as well as mitigate the most serious risks the industry faces. While feasible, expansion would be a complex process that involves many moving parts. Bringing early-stage processing back to Australia could also bring significant opportunities, such as pursuing emission reductions, and a new set of as yet unquantified challenges, chief among them—the diversification of an efficient supply chain that has naturally converged over many decades into its current structure.

Early-stage processing in Australia

The scope of analysis here considers early-stage processing of 170 million kilograms of Australian wool. This equates to around half the current volume exported from Australia and represents a share of the global wool supply chain that has been identified by industry as involving complex coordination of processing and logistics across multiple internationally dispersed locations. Accordingly, the barriers and benefits of the early-stage processing of 170 million kilograms, with subsequent export to diverse markets, were identified. Fundamentally, analysis showed that cost of production is not a material barrier to expanding processing in Australia. If driven by export demand, an expansion of early-stage processing in Australia could be internationally competitive and would have a positive impact on the Australian wool industry and the wider economy.

With capital investment, the early-stage processing and exporting of 170 million kilograms of wool to diverse markets could increase Australian wool industry output by $1.3 billion, increase gross domestic product (GDP) by up to $1.8 billion, and lift employment by up to 582 full-time equivalent (FTE) jobs, all by 2050. Revitalised domestic processing would impact not just the wool industry, but also the service and manufacturing sectors in Australia.

The outlook for processed wool varies depending on the degree of processing carried out in Australia. Two production systems are used in the early-stage processing of wool - the woollen and worsted systems. Both systems consist of two stages: wet processing; where greasy wool is scoured (cleaned) and potentially carbonised to remove grease, dirt, and other contaminants, and dry processing; where, depending on the production system, clean wool fibres are carded, combed and gilled to produce wool tops ready for spinning into fabric. In the woollen system, the scoured fibres may be processed further by carbonisation. They are then carded, spun, and used in products like tufted carpets. Worsted spun wool is scoured, then carded, gilled, combed, and drafted, then spun, each stage contributing to a refinement of the fibres that are used in fine-textured knits and fabrics. Australian wool is predominately used to supply worsted textiles.

Deloitte Access Economics evaluated the impact of wet-processing (scouring, or scouring and carbonising) and integrated, or early-stage, processing (which includes both wet-processing and the dry-processing stages that follow it, carding and top making). Both bring benefits, although scouring is less labour intensive and more competitive in Australia than dry-processing activities.

Different supply chain configurations were considered for this analysis based on their potential to provide diversification for the existing Australian wool supply chain. This required a comparison of Australian processing costs with those in China and selected international countries. The priority countries identified include India, Vietnam, Bangladesh and Indonesia based on strategic importance and market potential criteria.

All stages of processing are more expensive in Australia than most other countries. This is primarily due to higher wages, but also a consequence of the same commercial pressures, such as energy costs and environmental approvals, that saw processing offshored and machinery sold in the 1990s. Nevertheless, while labour remains more expensive in Australia, it does not present the same kind of barrier to the industry that it did in the 1990s. Partly, this is because domestic processing costs would be offset by transport costs. Sea freight from Australia direct to many other countries is significantly cheaper than from China (e.g. India 20%, Türkiye 80%). Lower transport costs are also partly due to the enormous weight differential between greasy wool and cleaned wool, whose volume and weight is reduced by approximately half when scoured.

Australia's competitive advantage lies in wet processing. Scoured wool could be exported to diverse markets around the world at an approximate 1% price advantage compared with the current supply chain. This advantage is reduced if undertaking the additional step of top making but could still be broadly competitive.

Markets for processed Australian wool

To address supply chain risk, new international markets must be identified and grown to diversify Australian wool exports. Deloitte Access Economics identified four priority markets, with both significant future growth potential and relatively congenial regulatory controls. They are India, Vietnam, Indonesia and Bangladesh. The selection was based on a high-level economic analysis of future demand and access issues, such as tariffs and non-tariff measures (NTMs) and expert input from the Steering Committee. Most markets are comparable on a delivered cost basis. The biggest difference is in the barriers raised by regulatory controls. In all identified locations, textile growth is expected to be strong, and each country has implemented a range of initiatives and strategies to specifically support that growth.

Tariff regimes are generally stable across all countries, including the chosen four, although Bangladesh may see European Union (EU) market access change in 2026. This is when Bangladesh is scheduled to graduate from the LDC status, meaning it would lose the duty benefit in the EU. Currently, Australian wool incurs tariff rates of 0% on greasy and processed wool in Vietnam and Indonesia, whereas tariffs for Bangladesh and India range from 5% to 10%. Tariff rates for India are expected to be reduced to zero and provide preferential access under an interim Australia India Economic Cooperation and Trade Agreement. In line with global patterns, non-tariff measures in all four locations are rising, but few yet apply to wool. Compared to China, the number of NTMs is low.

The risk of a disease outbreak

Australia is unique in the world for its stringent biosecurity and its fortunate geography. Being an island makes our biosecurity even more effective. Consequently, foot and mouth disease (FMD), and many other agricultural diseases, are not present here. Nevertheless, the general lessons of global transmission during the COVID-19 pandemic, combined with the recent identification of FMD in Indonesia — the closest it has recently come to Australia, make a re-examination of the wool trade's vulnerability appropriate.

Unlike in Australia, FMD is already endemic in several of the countries examined by this report. But each country manages disease and the importation of affected animals and animal products differently. While it's possible that some potential markets would not restrict the importation of greasy wool from Australia in the event of an FMD outbreak, it is reasonable to assume that in this situation, China would ban the importation of affected agricultural goods for a period.

In the event of such an outbreak and resulting ban, Deloitte Access Economics found that if Australia's wool trade remained concentrated on greasy wool to China, Australia would experience a significant economic shock. Wool exports would be halved in the first year of the outbreak and would effectively be stopped in the second year. A full recovery would be expected to occur in the third year. However, the devastating impact on trade, plus the domestic costs of treatment and recovery activities, would reduce wool industry output by $2.1 billion in peak affected years.

In contrast, if Australia expanded early-stage processing to 170 million kilograms of wool prior to export and was able to maintain open trade of that processed wool throughout the affected period, the same FMD event would result in wool industry output that was only $953 million lower, a difference of $1.1 billion in those years.

The risk of tariff imposition

Australia's concentrated wool market also makes it vulnerable to the imposition of tariffs or other regulatory measures that restrict trade in some way. Currently, the tariffs on Australian wool are moderate, between 1% and 5% depending on the product and country it is exported to. The risk of changes to tariffs is costly however, with Australian agricultural products particularly exposed. For example, recent years have seen Chinese tariffs of 80.5% on Australian barley and anti-dumping duties of 116% to 218.4% on Australian wine. Between 2018 and 2020, China and the United States engaged in a trade dispute that saw both governments place levies of approximately 15% on imports. If Australian wool was subject to a similar tax, the loss would be significant.

Deloitte Access Economics modelled the imposition of two different tariffs on Australian wool. In the first scenario, a 14.7% tariff on greasy wool is applied and gradually removed over six years. In the second scenario a tariff of 80.5% is introduced in 2037 and stays in place until 2050.

Overall, the impact of increased tariffs on Australia's wool industry would be dramatic but an expanded early-stage processing industry could significantly offset these impacts. A summary of the modelling results is shown in Table 1.1.

Table 1.1: Impact of tariff imposition on greasy wool exports, summary results peak affected year

Scenario	Impact on wool industry output	Impact with expanded early-stage processing	Net impact
14.7% tariff applied and reduced over six years	-$725 million	-$4 million	**$722 million**
80.5% tariff applied and remains in place	-$1.1 billion	-$392 million	**$741 million**

Note: Figures may not sum due to rounding

The risk of other regulatory measures

Historically, the use of tariffs has been declining across the globe, but other regulatory measures, known as non-tariff measures (NTMs), have increased. NTMs include biosecurity, health, and food safety requirements, as well as labelling and certification and other information requirements about a product's origin or importer. They may affect costs either directly or indirectly or limit the volume of exported goods.

Deloitte Access Economics modelled the imposition of two different NTMs on Australian wool. In the first scenario, a 1.0% increase in the cost of exporting wool was applied, such as what could be incurred through enhanced certification requirements. In the second scenario, an NTM that restricts the volume of exported wool is applied in 2037. This market access NTM represents strengthened import controls on extraneous matter in consignments such as soil, pests or weeds and has a similar effect on trade to that for FMD import controls.

As with the imposition of tariffs, new NTMs have a negative impact on Australia's wool industry but the expansion of demand-driven early-stage processing in Australia would offset these damages. A summary of results is shown in Table 1.2.

Table 1.2: Impact of imposition of non-tariff measures on greasy wool exports, summary results affected year

Scenario	Impact on wool industry output	Impact with expanded early-stage processing	Net impact
1.0% increase in cost of exporting	-$60 million	$542 million	**$602 million**
5-year market access ban	-$1.2 billion	-$386 million	**$788 million**

Note: Figures may not sum due to rounding

Capital investment in Australian wool processing

The expansion of wool processing in Australia would require significant capital outlay. A processing industry with the capacity to scour and comb 170 million kilograms would require $1,119 million in capital investment and 1,293 direct wool processing jobs. In this case, expenditure would increase in the first few years as construction occurs, peaking at $107.4 million in 2027. At the same time, the processed wool output would build, with the impact on the economy beginning to dominate after 2029. If only wet processing were expanded in Australia, the capital investment would be smaller, requiring an outlay of $567 million and 631 direct FTE jobs are required.

At a firm level, profitability is driven by maximising processing throughput. For example, the minimum viable size for a scouring operation would require a capital investment of approximately US$40 million with an annual greasy wool throughput of approximately 12 million kilograms per year. The payback period for such an investment is estimated to be at least 10 years.

With significant capital outlay, part of the expansion of wool processing in Australia could be achieved by local companies. But it is most likely that the Australian processing of 170 million kilograms of wool would require new entrants into the Australian market, which would also bring challenges of integration and competition.

Locating the necessary investment is expected to be a significant challenge. International commercial and institutional investments are not currently a feature of the Australian wool trade, and the pool of potential investors is limited, both here and internationally. Partly this is due to technical barriers. Along with the factories, the tacit knowledge of processing is concentrated in China. Stakeholders advise that passing wool through all processing stages is technically complex, relying on skill and science, which are generally only acquired through experience. But for potential investors, it is often the case that the more technical a process, the more uncertain the ability to recover costs. For investors coming from outside that world of knowledge, it is hard to assess whether an investment is configured optimally and how long it should take to reach optimal efficiency.

The challenge of supply chain diversification

Although early-stage processing in Australia has the potential to mitigate known vulnerabilities, it also brings challenges that require further understanding. The most critical of these is the forced realignment of a manufacturing supply chain that has naturally converged into a particular structure, and which has benefitted all parties over decades.

While the wool supply chain is complex and geographically fragmented, many activities are co-located or vertically integrated. Scours, for example, are often physically located close to the next stages of operation, such as carding and top-making, and early stages of processing are often co-located with later stages, such as spinning and other textile manufacturing operations. Reflecting this, much of the global wool processing capacity, up to and including the spinning stage is almost entirely located in China.

Expanding early-stage processing in Australia would be an experiment in reversing thirty years of globalisation but could be the next phase in supply chain evolution. The wool industry is not alone in their desire to diversify their supply chain, as other textile and manufacturing industries are also exploring this concept. However, there is evidence that those supply chains are also continuing to prioritise low-cost countries and face similar challenges in catalysing a restructure, including partner country capacity constraints.

This analysis considered the splitting out of wet and dry processing stages, which is rarely observed in existing business structures. Doing so is perceived by stakeholders at the processing end of the supply chain as uncertain and risky. Technical and logistical barriers to splitting out wet and dry processing stages are unexplored, and while it is not possible to predict specific impacts without further research, there is concern within the industry that losing control of inputs could disrupt timing, compromise quality, and result in yield losses.

Opportunities for positive environmental impact

Widespread interest in the ecological impact of goods, particularly in apparel, means that Australian wool is highly valued for its ecofriendly qualities. Wool is entirely natural and biodegradable. Designers can use Australian wool to create single origin collections, with traceability of materials from farm to fashion.

Traditionally, wool processing has been perceived as an environmentally demanding activity. However, since processing was last concentrated in Australia, there has been much innovation in the on-site treatment of wastewater and in the development of renewable energy, which promise incremental gains over the short to medium term. Additionally, exporting processed wool would reduce transport carbon emissions as scouring removes around a third of greasy wool weight.

Bringing processing back to Australia presents an opportunity to evolve those processes and reduce their impact, in line with consumer expectations and environmental need.

Barriers and opportunities

This report has quantified the magnitude of the risks that currently exist within the wool supply chain, and the potential for domestic processing to actively manage those risks in a cost competitive manner. However, the expansion of early-stage processing in Australia is unlikely to be fulfilled entirely by commercial means due to several barriers. The most significant being:

- high capital costs
- a limited pool of potential investors
- little appetite in industry for supply chain restructure.

In addition, the target markets identified for Australian processed wool have textile industries focussed on synthetic fibre and cotton creating a high degree of demand uncertainty. Further, the skills and relationships needed for industry to develop are not yet in place. Uncertainty also remains surrounding global wool textile and clothing industry dynamics, with a particular emphasis on industry relocation and structure.

Based on the analysis, there is a reasonable case for government support to underwrite the future of the Australian wool industry. This report recommends the undertaking of further research to produce two separate business cases.

1. One business case to consider pathways to strengthen demand in overseas locations.
2. A second business case to consider investment in processing capacity in Australia.

These business cases will provide an evidence base to assess the likelihood of risks, and the economic and social benefits that may be produced by such an intervention.

This report also makes a third recommendation to undertake a strategic review of investment in wool industry Research, Development and Extension (RD&E). This research would support the competitiveness of the industry's expansion. Priority areas of focus should include:

- Technical and logistical barriers to splitting wet and dry processing stages
- Potential value-adding opportunities to processing and waste outputs
- Innovation in processing inputs including on-site wastewater treatment, labour and energy

Funding could be secured from a range of sources including through traditional agricultural industry pathways such as levy funds and could complement existing government schemes such as the Modern Manufacturing Initiative.

Deloitte Access Economics

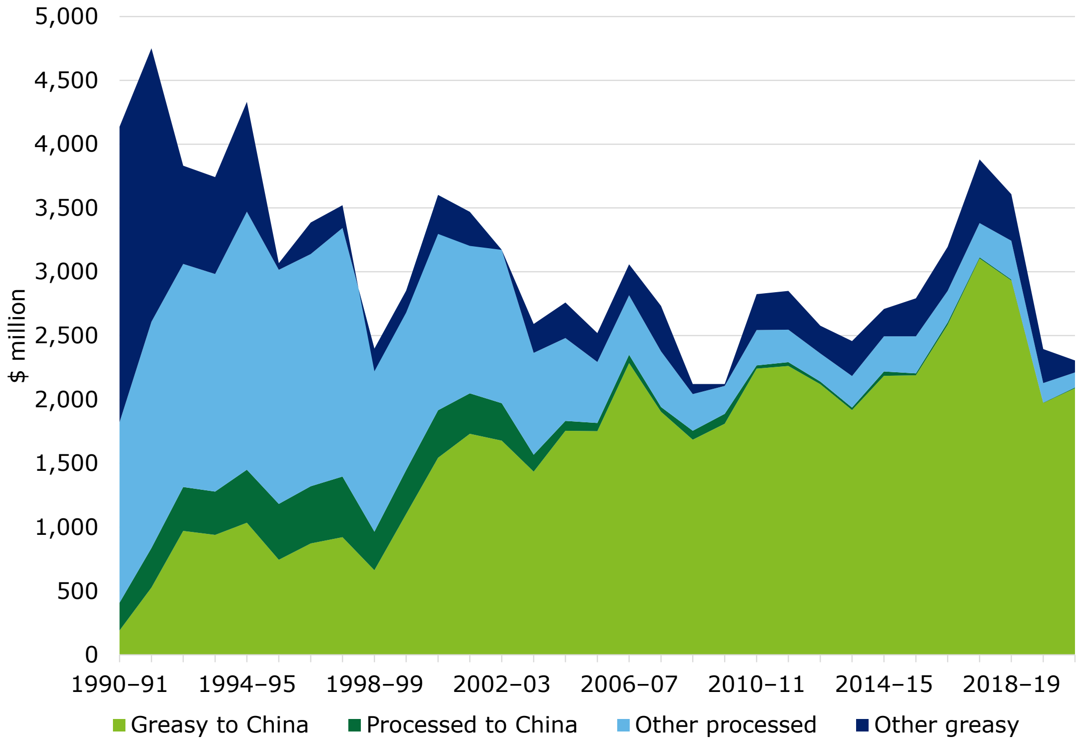
1 Introduction

Australia's wool industry is particularly exposed to global supply chain risks. This report analyses the viability of expanding early-stage processing in Australia and its potential to manage emerging risks.

Wool is an important thread in the fabric of Australia. The industry's footprint is centred in regional Australia and starts at the farm. More than 18,000 people are employed in specialised sheep farming and more than 2,500 in shearing services.[i] Wool production complements mixed farming enterprises, with more than 31,500 businesses across Australia holding sheep as of June 2020.[ii] According to industry, the broader wool supply chain supports approximately 200,000 jobs across production, farm services, research and marketing.[iii,ii]

The industry is among Australia's most export orientated agricultural industries.[1] Effectively all wool is exported, earning around $3.6 billion in export income in 2021-22. Virtually all trade is in unprocessed (greasy) form and shipped to China (Chart 1.1). In 2020-21 this portion of trade accounted for 90.6% of the total with this share steadily rising over time. Australia also exports a small amount of processed wool to China, although the processed trade in total accounts for just 5.2% of the value of all wool exports.

Chart 1.1: Australian greasy and processed wool exports to China and all other destinations



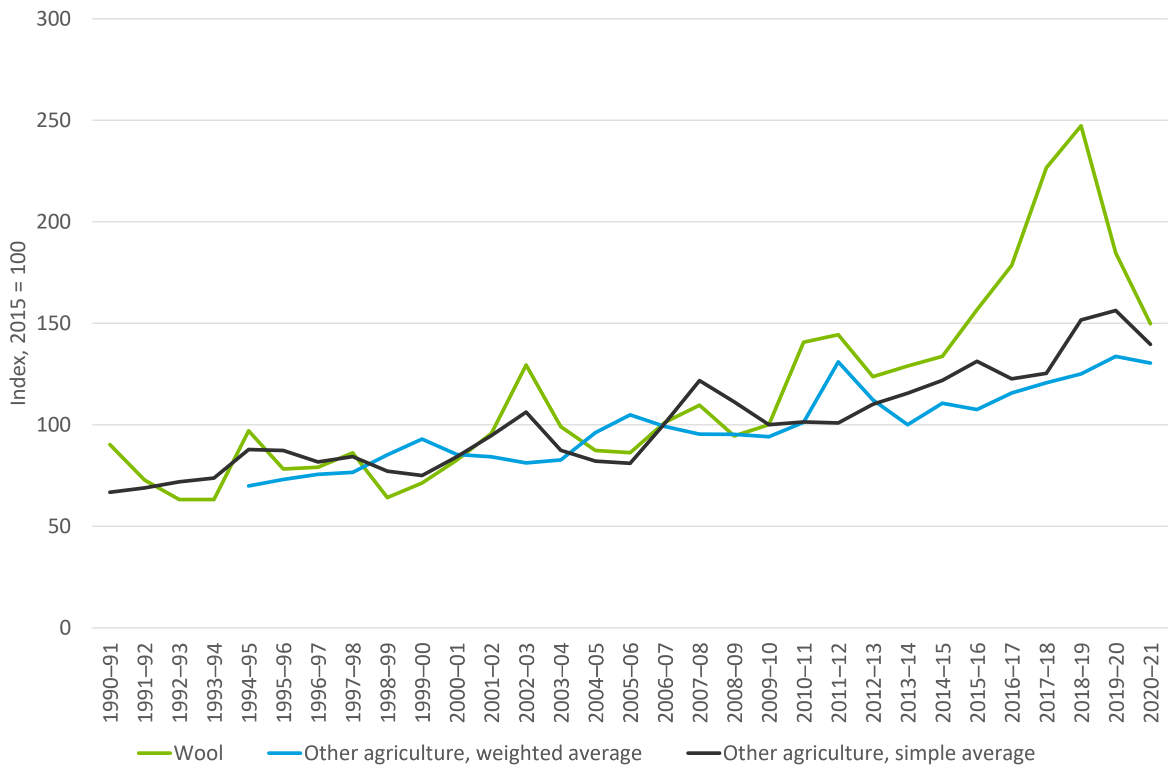
Source: ABARES (2022).

Note: Excludes skins.

[1] The share of agricultural output exported is estimated by ABARES at around 72%.

The steady concentration of Australia's wool exports into greasy trade and to China has been a welcome aspect of Australia's wool supply chain since the 1990s. Indeed, many stakeholders engaged during this project emphasised that the greasy trade to China was largely responsible for holding the Australian wool industry together during the turbulent 1990s and early 2000s. This appreciation of the greasy trade to China is reflected in the fact that unit prices for Australian wool have increased by around 150% since 2005-06 (compared with 130% averaged across all other agricultural commodities) and are around twice that received in 1990-91.

Chart 1.2: Unit prices for wool and average for other Australian agriculture



Source: ABARES (2022).

While beneficial, many stakeholders have expressed concern that such a concentrated supply chain leaves Australia's wool industry overexposed to emerging risks on the global market. Chief among these risks is the potential for an emergency animal disease event, such as an FMD outbreak, to effectively halt all trade in greasy wool to overseas markets.

WoolProducers Australia (WoolProducers) has commissioned Deloitte Access Economics to analyse the potential for the Australian supply chain to manage these emerging risks. This report focuses on the feasibility of domestic early-stage processing to mitigate emerging risks. It also provides key insights into the potential operating environment in Australia and its comparative advantages, information that is critical to both long term viability and aligning with the future strategic direction of Australia's wool producers.

The remainder of this report is structured as follows:

- Sections 1 and 2 discuss the wool supply chain, and early-stage processing in Australia
- Section 3 discusses priority locations that might support diversification of wool exports
- Section 4 assesses the cost competitiveness of early-stage wool processing
- Section 5 outlines the impacts of risk exposure
- Sections 6 and 7 outline other impacts, as well as barriers and opportunities

2 Background on Australia's wool industry

The wool supply chain consists of many stages from farm production to the textile market and end consumer.

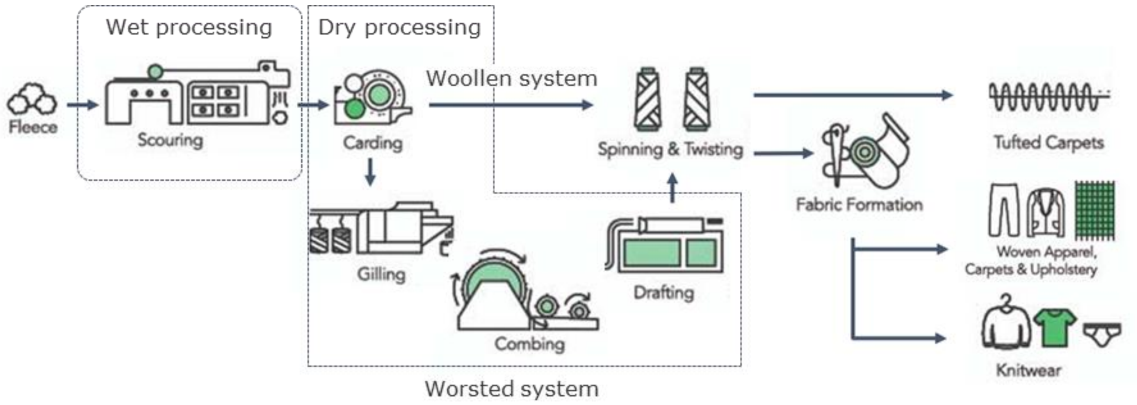
2.1 The wool supply chain

Wool is a textile fibre obtained from mammals and is most typically associated with sheep farming systems. Wool is a costly product to produce requiring a range of inputs to grow and harvest compared to other fibres. For example, the costs incurred by Australian farmers to produce a kilogram of wool were estimated at 255 cents per kilogram in 2021 prices.[iv] This is around 24% higher than that reported for cotton growers, at around 205 cents per kilogram.[2,v]

Not only is wool relatively more costly to produce, but as a natural fibre, its production is highly variable. Wool is influenced by an interacting array of livestock genetics, farm management practices and geographic and climactic factors. These factors can result in wide variations of fibre length, strength and diameter. As processing, and ultimately consumers demand uniform inputs for their supply chains, the wool processing industry is understood to be relatively complex and therefore costly.[vi]

This section outlines each stage of the supply chain from farm to textile markets. A summary of the supply chain is illustrated in Figure 2.1, with individual stages covered in the following sub-sections. The supply chain outlined focuses on merino production, which typically enters worsted processing systems and supports apparel markets that are centrally supplied by Australian wool. Other systems, such as worsted processing of broader micro wool fibres are also discussed.

Figure 2.1: Stylised depiction of worsted and woollen processing systems



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

Worsted-spun woven fabrics are used by fine tailors around the world for clothes such as business suits, trousers and skirts. Worsted-spun knitted fabrics are super-soft, incredibly versatile knits that are used for baby clothes, underwear, t-shirts and sportswear, leggings, dresses and other light-weight knitwear. Woollen fabrics are used for items such as jumpers, sweaters, scarves and socks. New spinning innovations have produced wind and waterproof wool fabrics.

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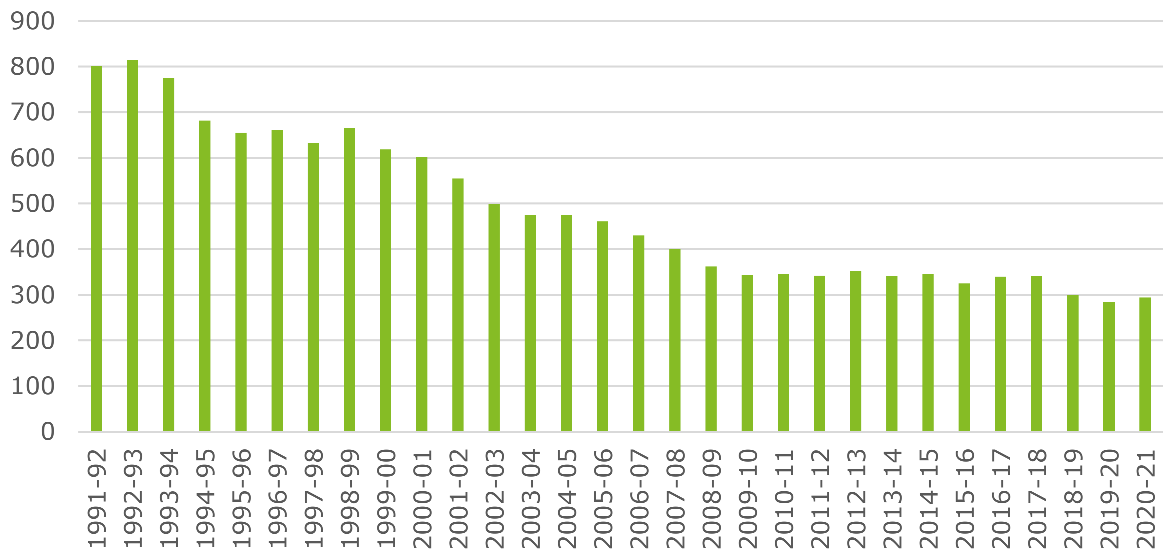
[2] Average cost of production in 2009 and 2010 was 384.0 per bale. Assumes average bale weight at 227 kg.

2.1.2 Farm production

According to the International Wool Textile Organisation (IWTO), global wool production has declined from around 1,340 million kilograms (clean) in 2000 to 1,030 million kilograms in 2021.[viii] The decline has been in the supply of apparel wool supplies, and particularly of merino wool from Australia.

Since 2000, the volume of wool produced in Australia has declined by around 50% (Chart 2.1). This reduction reflects reduced sheep numbers and farmers, which declined at similar rates during this period as a result of changes to the market and policy environment, including the collapse of the Reserve Price Scheme.

Chart 2.1: Australia's shorn wool production (million kilograms greasy)



Source: Australian Wool Innovation (AWI) (2021).

Despite the decline, Australia remains the single largest supplier of wool, particularly of merino apparel wools. In 2020, Australia was estimated to have accounted for around a fifth of the world's wool production with other notable but smaller suppliers including South Africa, New Zealand, Uruguay and Argentina.

Wool also remains central to the Australian agriculture sector, generating an average annual farm gate value of $3.6 billion in the five years to 2020-21. It also maintains a central role in the broader economy, with industry reporting the wool supply chain employs approximately 200,000 people across production, farm services, research and marketing.[ix]

Alongside the evolving economic footprint of wool in Australia, the industry continues to pivot its focus towards fine apparel markets. Over the last 30 years, the Australian wool clip has increasingly consisted of wool that is 20 microns or less, with this fibre diameter now consisting of more than half of Australia's wool clip. There is also a growing portion of Australia's wool clip that is greater than 27.5 microns reflecting a shift in the flock structure to farm specialisation of meat and carpet wool breeds.

2.1.3 Wool sales, brokers and exporters

Once harvested via shearing, wool begins its journey to processors and onto textile markets. There are a variety of important supporting industries that facilitate these trade flows, including testing, auctions, brokers and exporters.

Wool can be sold in several different ways, including from auctions, directly from wool producers in private sales, electronic offer boards and from wool selling brokers. It is estimated that approximately 85% of wool produced in Australia is traded through open cry auctions.[x]

Wool brokers provide marketing, warehousing and handling services to wool growers. The wool broker will arrange for the lines of wool to be tested, stored and catalogued for (auction) sale. The wool broker does not generally take ownership of the wool, rather the broker will offer the wool for sale on behalf of the grower. In doing so, the broker transfers sale proceeds from the buyer to the grower post sale with handling charges, testing charges and wool levies removed.

Exporters (or buyers) are the entities that purchase the wool from the auction. The exporter may be buying wool for themselves or clients. Exporters manage the financing, risk management, sample inspection, purchasing or bidding, and logistics associated with moving wool from the wool broker store through to early-stage processing and beyond.

2.1.4 Early-stage processing

Early-stage processing consists of a wet-washing stage followed by several mechanical stages where greasy wool is prepared for latter-stage processing. Here early-stage processing is defined to include two groups of actions: scouring and carbonising; and carding and top making. Depending on the staple (fibre length) and fibre diameter, wool can be processed through either the woollen or worsted processing system.

The worsted processing system requires fine long-staple fibres to produce fine to very fine yarns, which can be woven to make extremely smooth and lightweight worsted fabrics, e.g. suiting fabric. Most of Australia's wool is processed through the worsted system. In the woollen system, woollen spun woven fabrics are thicker and heavier and used mostly for outerwear, being bulkier than worsted-spun knitted fabrics. There are several steps in each of these processing systems, including carding and spinning.

2.1.4.1 Scouring – Carbonising

Scouring is the process of cleaning wool by removing grease (lanolin), vegetable matter (seeds, sticks, grass), and dirt (sand, soil). Scouring companies are typically vertically integrated or located close to carding and top-making operations. Most scourers are located in China, although Australia currently has three scours.

Wool that has been shorn is known as greasy wool because it contains grease, the basis of which is lanolin, but also contaminants such as dirt, dust and sand. Although it depends on genetics and the environment in which sheep graze, contaminants can often account for approximately 35% to 40% of the total fleece weight.[xi] Before wool can be further processed, these contaminants are removed through scouring.

The process of scouring involves the greasy wool being continuously fed and agitated through a series of hot water and detergent bowls (baths) where most water-soluble compounds (suint), dirt and grease are removed. Water insoluble compounds are removed by putting the wool into a continuous drier and several machines that mechanically beat the wool. Lastly, the wool is blended and allowed to stand to condition until its moisture content reaches equilibrium. It is then ready for the next stage of manufacturing known as top-making.

The approach to successful scouring of greasy wool in terms of quality is to effectively remove almost all the different types of contaminants, whilst ensuring entanglement of the fibres or felting is minimised.

If there is a high percentage of vegetable matter, wools may also be carbonised. This involves a treatment after scouring where the wool is immersed in dilute sulphuric acid. This, combined with heat treatments, leaves vegetable and other extraneous matter dry and brittle. The wool is then transported through rollers that crush the extraneous matter into dust which is removed in a rotary shaker.

2.1.4.2 Carding, Combing and Gilling

Carding prepares the wool for spinning and occurs in both woollen and worsted systems. Carding aligns the individual fibres by passing the clean wool over sets of wired cylinders to open, straighten, separate and then condense the fibres into a uniform aggregate assembly. The result – a long rope of wool – is known as a top. Carded fibres are generally used for producing woollen yarn and go directly on to the spinning stage.

Shorter, coarser wool destined for the woollen system undergoes carding which prepares the fibres directly into a slubbing. This mechanical process is performed by a woollen card, after which the slubbing can go directly on to the 'woollen' spinning stage.

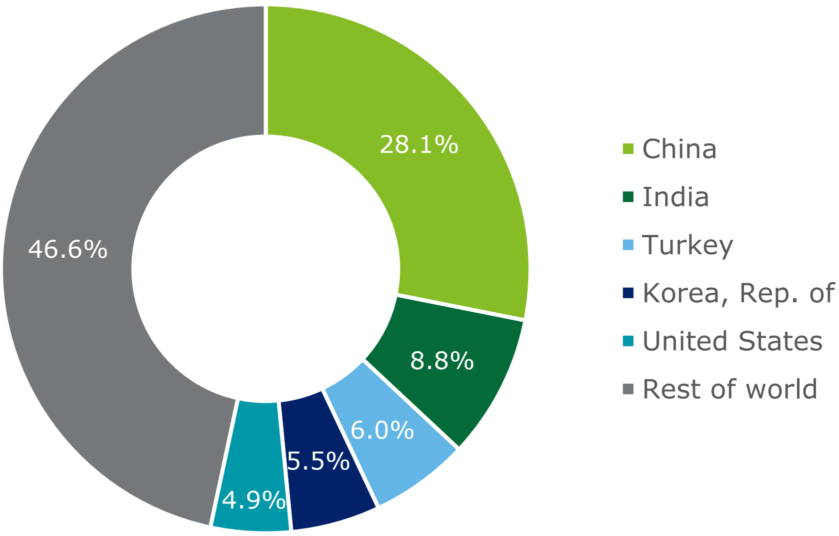
Before a worsted yarn can be spun, the carded top needs to be gilled (to straighten the fibres by stretching the sliver) and to further blend the carded top, and then combed to remove the short fibres (noils) and any remaining vegetable matter. Gilling is done to align the fibres so they can pass through the combing machine, produce a sliver with a more uniform weight per course length and add processing aids to the fibre. Following gilling, combing separates the fibres of the wool through long metal teeth or tines. The fibres become aligned and parallel to each other. Fibres that are too short, referred to as noils, are removed by this process. The combed sliver will then be wound into a ball, and this is known as wool top. This preparation is generally used in preparation for making a worsted yarn.

2.1.5 Spinning

After early-stage processing, wool is formed into yarn by drafting fibres, inserting twist and winding the yarn onto a package. This process is known as spinning and occurs in both woollen and worsted systems. While spinning in the two systems include different activities, spinning ultimately aims to produce a continuous, cohesive strand of fibres (i.e. the yarn) for use by the textile industry in knitting or weaving applications.

Like early-stage wool processing, wool spinning is also largely concentrated in China. However, spinning is also performed across almost all other fibres, including other natural fibres such as cotton. For this reason, global spinning capacity is relatively more dispersed than early-stage wool processing. This is illustrated in Chart 2.2 which describes global shares of installed capacity of long-stable spindles for selected countries.[xii] 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 2.2: Share of global installed capacity of long staple spindles at 2021



Source: IWTO (2022).[xii]

2.1.6 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:

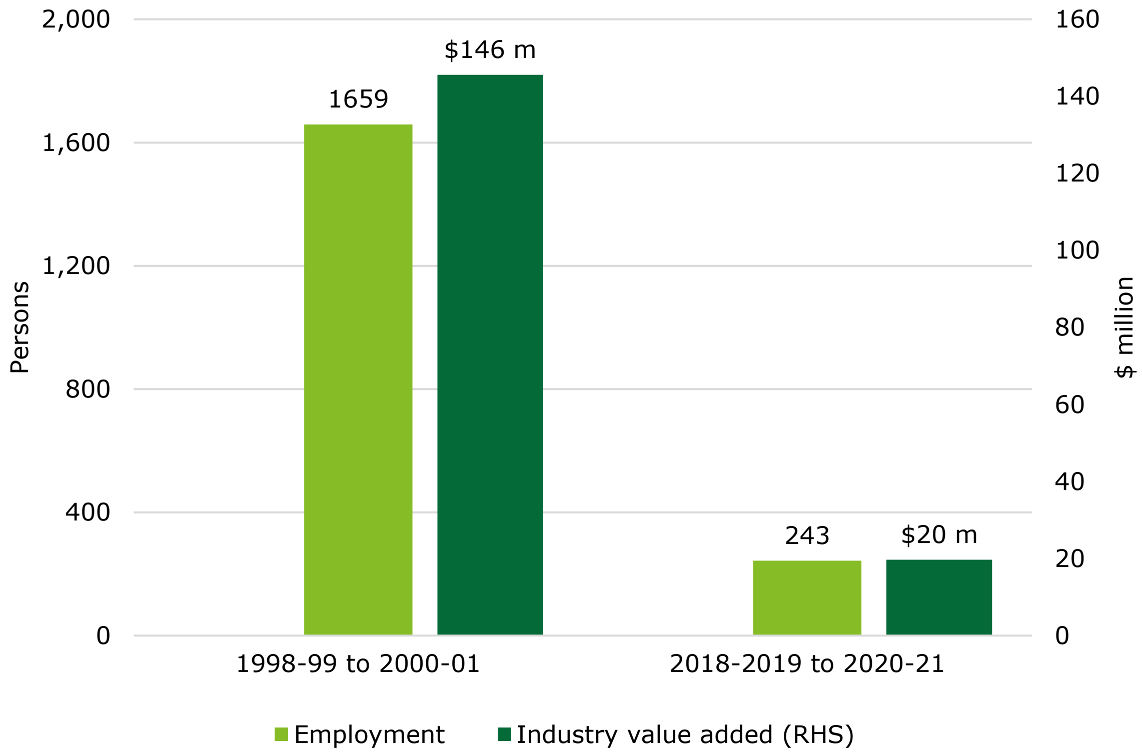
- Weaving - a series of processes which converts yarn into a fabric that is suitable for tailoring via interlacing two sets of yarns on a loom.
- Knitting – conversion of yarn into fabric by bending yarn into loops which are then intermeshed with other loops of the same configuration
- Wool carpet manufacturing - textile floor covering with a top layer comprised of multiple yarn segments, arranged in a compact formation as short loops or upright tufts.[3]

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 significant suppliers. These countries supply consumers around the world, with most trade focussed on major markets with high incomes and large populations such as the United States, Europe and Japan.[xii]

2.2 Early-stage processing in Australia

Although Australia produces a significant volume of the world's wool, most is exported greasy without processing (see Section 1). 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. However, almost all of these wool processing factories have since shut down and most wool is now sent overseas to be cleaned and spun into yarn. Today though the processing industry is around 14% of its former size at the turn of the millennium (Chart 2.3).

Chart 2.3: Headline economic statistics for Australia's early-stage wool processing sector, 3-year averages



Source: ABS (2022).[xiii,xiv]

[3] There are three main methods of making wool (and wool rich) carpets and rugs: hand-knotting, weaving and tufting.

Between 1997-98 and 2000-01, early-stage processing of wool in Australia generated around $150 million in value added and employed 1,700 people. In 2003, there were 15 early-stage processing companies in Australia, with most of these companies leaving Australia between 2003 and 2010. Part of this consolidation is explained by a broader decline in world wool supply, with the Australian flock contracting by around 40% during this period. However, this period also saw many Australian operations exit the industry due to commercial pressures, including high costs of energy and labour, as well as the pressure to obtain increasing environmental approvals. This resulted in the selling of machinery to firms relocating or establishing, particularly in China.

Today Australia's wool processing industry has a value added of $23m and employs around 145 people. The 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.[4] 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.

2.3 Manufacturing and textiles megatrends

The interest of the wool supply chain in exploring diversified supply chains is not unique. Across both manufacturing and textiles, a range of megatrends are driving change including the restructure of supply chains. Driving forces include the want for greater transparency in sustainability and ethical production, as well as the avoidance of risks related to supply chain disruptions.

The growing interest in restructuring supply chains is demonstrated in a recent survey of fashion industry Chief Procurement Officers (CPO). This survey found 71% of respondents plan to increase their nearshoring strategy in the future.[xv]

While alternative supply chain structures have become increasingly attractive there is mixed evidence such reforms are taking hold. The 2021 Kearney's Annual Reshoring Index reported firms in 2021 and 2020 were strongly relying on manufacturing in low-cost countries.[xvi]

This lack of change likely reflects real challenges in rethinking global supply chains. The US Fashion Benchmarking Study reports three key shifts that are necessary for the western hemisphere to be a viable destination – more competitive product prices, increased fabric and textile raw material production capacity, and less restrictive rules of origin for relevant US trade agreements.[xvii]

[4] Michell Wool also manage a wool scour in China and are involved in other aspects of the supply chain in Australia, including exporting broking.

3 Priority trade opportunities

3.1 Purpose

This Section identifies a select list of priority opportunities that may provide potential diversification opportunities for the Australian wool supply chain. The methodology for selecting priority countries is provided before a summary of high-level economic findings across priority markets.

3.2 Methodology

Prioritisation of shortlisted locations was undertaken in a two-stage process. Stage 1 involved developing a shortlist of seven viable locations with Stage 2 prioritising those markets based on high-level economic analysis. Both stages are described in the following sub-sections.

3.2.1 Stage 1: Shortlisting of locations

In this initial stage, a shortlist of locations was derived for further analysis in Stage 2. Locations were shortlisted in a process that combined industry expertise through consultation with the steering committee and analysis of both broader strategic and economic information. A summary of these aspects is described below:

Expert elicitation: The project includes a Steering Committee with members covering the wool supply chain including WoolProducers Australia (WPA), Australian Wool Innovation (AWI), National Council of Wool Selling Brokers of Australia (NCWSBA), Australian Council of Wool Exporters & Processors (ACWEP), Australian Wool Testing Authority (AWTA), and Australian Wool Exchange (AWEX). The Steering Committee provided expert views on current processing capacity, recent trends and opinions on future potential growth.

Scan of strategic priorities: Investigation of opportunities to diversify the wool supply chain is occurring alongside a host of other strategic efforts in Australia. A scan of declared strategic priorities was undertaken to understand what locations could be compatible. Major sources included AWI's Emerging Market Strategy,[xviii] the Australian International Business Survey,[xix] the Inquiry into Diversifying Australia's Trade and Investment Profile[xx] and similar work by Austrade that assessed opportunities to diversify Australian cotton exports.[xxi]

Data-driven location prioritisation framework: The data-driven approach consisted of quantitative analysis of the global wool industry using a location prioritisation framework. This framework included criteria on textile processing capacity, manufacturing and logistics, preference advantages and freedom of trade. Weightings on the criteria prioritised textile processing capacity and manufacturing and logistics due to their influence on the capacity to establish a wool industry.

Combining the sources above, a list of seven countries was agreed and shortlisted for further analysis and prioritisation. This included (in alphabetical order):

- Bangladesh
- Czechia (Czech Republic)
- India
- Indonesia
- South Korea
- Türkiye
- Vietnam.

3.2.2 Stage 2: Prioritisation through high level economic analysis

Once the shortlist of countries was determined, high level economic analysis was undertaken to determine priority opportunities for diversification. This second stage of analysis involved assessing countries across factors outlined in the terms of reference, including:

- Future market demand
- Market access – tariffs
- Non-tariff market access issues, including animal disease restrictions and domestic regulatory settings.

The analysis found that across these factors, four markets showed increased prospects for diversifying trade in Australian wool, these are: **India**, **Vietnam**, **Indonesia** and **Bangladesh**. A range of other attributes were also considered during the analysis although most locations were found to be comparable across these aspects. The assessment of the shortlisted locations against the above priority issues is summarised in the following section with further detail on individual countries provided in Appendix A.

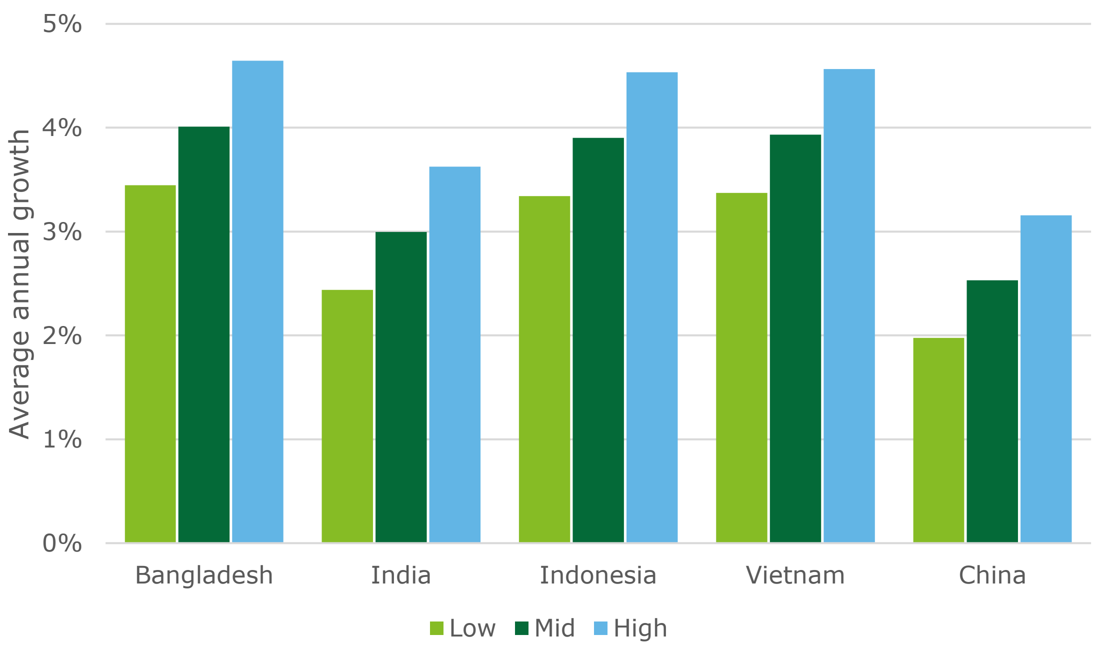
3.3 Prioritisation of location results

This section outlines the results of the two-stage prioritisation process, including the shortlisting of viable locations, and the final prioritisation list.

3.3.1 Future market demand

Across the priority countries, textile growth is projected to be strong (Chart 3.1). In India for example, textile value added is projected to grow by 3.0% per annum out to 2050 (mid scenario), compared with steadier average growth in China of 2.5% per annum (mid scenario). Growth in the Indian manufacturing sector and textile industry is assumed to occur amidst broader rapid economic growth and mirrors strong results in Vietnam (3.9% per annum) and Bangladesh (4.0% per annum). In Indonesia, a similarly strong expansion in textile manufacturing is projected, with average annual growth projected at 3.9% out to 2050 (mid case).

Chart 3.1: Projected annual average textile industry value added growth, to 2050



Source: Deloitte Access Economics (2022).

In support of future growth in textiles, the priority countries each have a range of initiatives and strategies. Bangladesh for example, has a long-term development strategy, Vision 2041, that includes policy support for high-end Ready-Made Garments, the current focus of the local textile industry. The National Manufacturing Policy in India and Vietnam's Industrial Development Strategy to 2025 also provide roadmaps for future growth in local textile manufacturing, while the Making Indonesia 4.0 targets textiles as one of five strategic industries to support broader objectives of growth in economic activity, exports and employment.

3.3.2 Tariff access to markets

Market access is also anticipated to play a key role in future textile industry growth for the priority countries. Vietnam has recently obtained preferential access to the EU market via a free trade agreement. This has supported recent accelerated growth and may provide support for higher growth over the longer term. Bangladesh in contrast is set to see EU market access (granted under Least Developed Country status) change in 2026. This may soften investment appetite, and poses a longer-term downside risk for growth in Bangladesh's textile industry. Neither India nor Indonesia have preferential access to major markets in the EU, USA or Japan. Negotiations are underway between Indonesia and the EU on a free trade agreement, although any improved market access that might result is likely to develop over the longer term, reflecting the general speed of negotiations and stages before entry into force.

Current tariff access for Australian wool exports (including semi processed products) is in general comparable across the priority countries (Table 3.1). In Vietnam and Indonesia for example Australia faces flat tariff rates of zero per cent across greasy, clean and carded or combed wool with free trade agreements providing preferential access when compared to Bangladesh or India where current tariff rates range from 5% to 10%.

Table 3.1: Tariff rates faced by Australian wool exports to priority countries.

	Greasy	Scoured	Carbonised	Carded	Combed
Bangladesh	5	5	5	5	5
India: existing	5^	5	5	10	7.5-10
India: IA-ECTA	0*	0*	0*	0#	0#
Indonesia	0	0	0	0	0
Vietnam	0	0	0	0	0

Notes: * refers to upon entry into force; # refers to after 7 years; ^ advice provided by industry has indicated that greasy tariff rates applied by India can vary between 0% and 25%

China mostly faces the same tariff rates as Australia, so no preferential access currently exists for Australian exports direct to the priority countries. An interim Australia India Economic Cooperation and Trade Agreement (AI – CETA) was signed in April 2022 and this is expected to reduce tariff rates faced for Australian wool exports and provide preferential access for Australia, particularly compared to China. If entered into force, Australian tariffs are slated to be reduced to zero, with greasy and clean wool occurring upon entry into force, while carded combed wool would be reduced over 7 years.

3.3.3 Non-tariff access

Of particular interest are sanitary and phytosanitary (SPS) non-tariff measures (NTM), and the potential for an animal disease outbreak in Australia to affect market access for wool. Greasy wool, as an unprocessed agricultural product, is likely to face considerably greater market access changes than semi-processed wool.[5]

Country level regulation of imports from areas affected by animal disease issues is highly variable and influenced by an array of political, agricultural and social factors. This includes for example the history of disease, government control efforts and prevalence of other risk pathways. The

[5] This is because the importation of wool from FMD infected countries the WOAH's Terrestrial Animal Codes specifies that veterinary authorities should require an international veterinary certificate attesting that the FMD virus has been destroyed through industrial washing or scouring, fumigation, or storage at 18°Celsius for four weeks, 4°C for four months, or 37°C for eight days.

variability in trade and market access responses to animal disease outbreaks is highlighted in Box 1 which describes recent experiences in South Africa where trading partners responded differently to recent FMD outbreaks.

A summary assessment is provided in Table 3.2. Countries considered to be a lower risk to market access for Australian wool include Bangladesh (BGD), Czechia (CZE), India (IND), Türkiye (TUR) and Vietnam (VTN). For Czechia and India, trade continued with South Africa after its 2022 FMD outbreak (see Box 1). For Bangladesh, Türkiye and Vietnam, FMD is endemic and while government programs are in place, the risk of future outbreaks in those countries are high due to cross border livestock movements and other pathway risks.

Table 3.2: Summary assessment of market access risk from an Australian FMD outbreak.

	BGD	CZE	IDN	IND	KOR	TUR	VTN	CHN
Trade with South Africa	n.a.	Yes	n.a.	Yes	n.a.	n.a.	n.a.	Ceased
FMD present	Endemic	No	Yes (current outbreak)	Endemic	No	Endemic	Endemic	Endemic
Strength of in country controls	Low	n.a.	Very high	High	Very high	High	Moderate	High
Cross border pathway risks	Very high	Low	Low	Very high	Low	Very high	High	Moderate
Trade agreement	No	No	Yes	Yes	Yes	No	Yes	Yes
Assessed risk to market access	Lower	Lower	Higher	Lower	Higher	Lower	Lower	Higher
Confidence	Moderate	High	Low	High	Moderate	High	Moderate	Moderate

Sources: Refer to Appendix A. Note: IDN = Indonesia, KOR – South Korea, CHN – China

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

On April 11 2022, the Minister of Agriculture, Land Reform and Rural Development (DALRRD) announced that South Africa was attempting to control an outbreak of 56 cases of FMD. Following the loss of the World Animal Health Organisation (WOAH) recognized FMD-free status in January 2019, DALRRD negotiated agreements with trading partners on the export of safe commodities, including scoured wool. Although these agreements allowed for a continuation of trade, China, South Africa's major wool market, implemented trade restrictions. Like Australia, China was South Africa's primary export market for wool and the trade was mostly greasy.

In April 2022, China announced a restriction on the import of all cloven-hoofed animals and their products from South Africa due to an outbreak of FMD in five provinces. Exports were only to resume once new measures were implemented as required by China, including registration of export facilities with China and inactivation of the FMD virus. China is not listed as free from FMD or as having an FMD free zone with the WOAH. In May China issued a response that signalled processed wool (scoured) from South Africa would be eligible to be imported. China removed its ban on wool imports from South Africa in late August 2022.

Across other trading partners for wool, trade with South Africa in 2022 was:

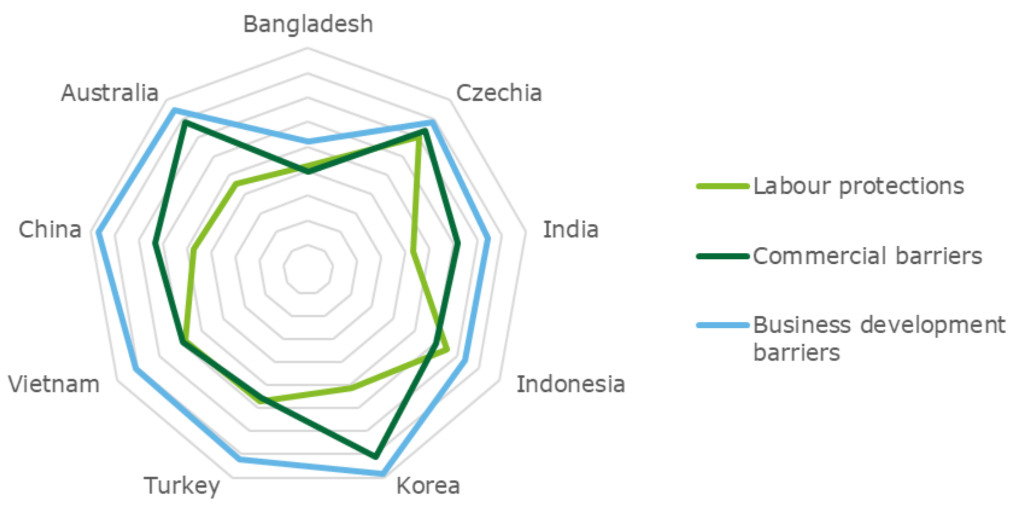
- unaffected with Europe (including for Italy, Czechia and Bulgaria which are listed as FMD free where vaccination is not practiced)
- allowed to India (where FMD is endemic) if certified from FMD free zones

South Africa negotiated restoration of market access to China in 2019 based on the storage parameters in the WOAH Terrestrial code (4°C/4m, 18°C/4w, 37°C/8d). While this provided restoration of trade it incurred additional supply chain costs through the need to heat wool warehouses and the need to hold stocks of wool for longer times.

3.3.4 Other barriers

For most other factors, the shortlisted countries are relatively comparable with only a few differentiating aspects. For example, data suggests labour protections, which describes the degree to which employees are protected in countries, are marginally higher in Czechia and Indonesia, compared to other countries, including Australia (Chart 3.2). These regulatory criteria are separate from labour costs, which are considered in Chapter 4.

Chart 3.2: Summary labour, commercial and business development indicators for selected countries

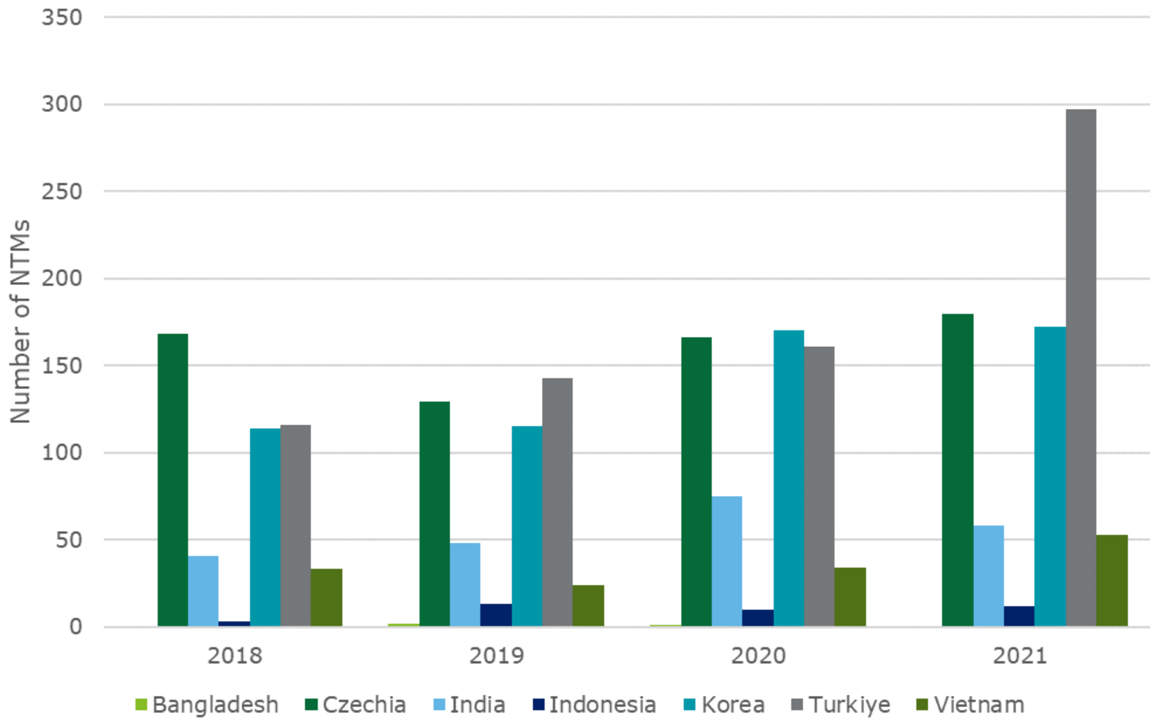


Source: WTO, ILO and CREDENDO (2022).

Further, barriers associated with construction and business development show only Bangladesh as notably lower than other regions. Commercial barriers meanwhile, which describes risks of doing business in specific countries, are largely correlated with income levels, only Türkiye is an outlier ranking lowest despite being a high middle-income country. This reflects the ongoing business risks that exist as a result of the country's ongoing economic troubles.

Other aspects considered also included risks of non-tariff measures (other than specific animal disease related issues). In all countries analysed, wool faced no specific NTMs and the risk of future strengthened NTMs was broadly comparable. While some countries have greater prevalence or coverage of NTMs currently, it is assessed that NTM use is broadly rising across all shortlisted countries (Chart 3.3). This increased use is being led by SPS measures as well as technical barriers and poses roughly equivalent risk to market access for Australian agricultural trade over the long term.

Chart 3.3: NTMs in force by selected country, 2018 to 2021



Source: WTO (2022).

4 Competitiveness of wool processed in Australia

Australia could be cost competitive in delivering processed wool to global customers. Early-stage processing is more expensive in Australia. However, considerable transport efficiencies offset this difference. As a result, the total cost delivered to customers is broadly similar when compared to the current supply chain.

4.1 Purpose and scope

Many Australian wool industry members see the expansion of early-stage processing as a key strategy to manage emerging supply chain risks such as an animal disease outbreak. This section examines whether expanded processing capacity in Australia could be commercially viable. The potential this processing capacity could have for risk mitigation is then explored in Section 5.

The scope of the analysis considered:

- worsted and woollen processing systems which involve different wool types and service differing end markets.
- splitting wet and dry processing.

Analysis for this report examined Australia's commercial viability through the bottom-up modelling of a representative processing enterprise. This focused on a commission-based business model, where processors are engaged by third parties who have purchased wool and are charged tariffs based on wool weight (on a per kilogram basis).[6,7]

4.2 Methodology

The modelling relied on information and data provided by a range of sources. This included:

- desktop research
- consultations with the processing industry
- expert opinion from other industry stakeholders.

The modelling estimated the cost of wet (i.e. scouring and or carbonising) and dry (i.e. carding or top making) processing in both Australia and several international locations. The scope of analysis was contained to a subset of the previously listed selected locations. This was based on consultation with the Expert Reference Group and industry members which identified limited potential for scouring to be undertaken in some overseas locations due to local wastewater regulations.

[6] Tariff is an industry term equivalent to fee or charge; this is not to be confused with a trade or customs tariff.
[7] The commission basis and location assumptions of this study were informed by the existing business models of all operating early-stage wool processors in Australia. However, it is acknowledged that other business models are possible. Where possible, these issues have been considered in a sensitivity analysis (Appendix D).

Table 4.1: Countries considered in competitiveness analysis.

Dry processing only	Wet and dry processing
Bangladesh	China
Vietnam	Czechia
South Korea	India
	Indonesia
	Türkiye

A range of scenarios were built to identify enterprise configurations that would represent a new entrant into the Australian or world market. Key considerations included scouring width, labour use and shift set up and hourly throughput. From the wide array of choices across these factors, a central scenario was developed based on two different supply chain models:

1. *Only* wet processing occurs in Australia before export to an international location
2. Wet *and* dry processing into tops in Australia before export.

As such, the analysis considered only the potential to split, and so the individual cost of, wet and dry processing. Modelling integrated dry processing (carding, gilling and combing) is based on industry advice that these activities are typically undertaken in close proximity. However, it is possible that dry processing could be further split into its individual components. Given inputs (including capital, labour and consumables) are relatively consistent across each stage of dry processing, the findings are expected to be consistent.

The analysis has focussed on the above-described pathways in part because early-stage processing in Australia has the potential to actively manage the risk presented by animal disease events such as FMD. Greasy wool exports do not actively address this risk, but development of greasy export markets may also support diversification and manage other emerging risks. Under such a scenario, early-stage processing would take place in trading partner countries. Analysis on this point is implicit in the method used where, if international countries were able to scour wool on a basis that is competitive with that estimated for Australia, those locations may present opportunities to develop independent scouring capacity.

4.3 Cost delivered to customer in priority locations

This section presents results of the cost to deliver either scoured wool or wool tops to priority locations around the world from either Australia or China.

The global wool market is extremely competitive. If Australian early-stage processing is to be viable, it must be able to deliver product at a comparable or lesser cost than the current industry status quo. For this reason, costs are compared to those in China, where most early-stage processing currently occurs.

Of all the counties considered in the analysis, four locations were a priority for developing wool product markets were:

- Bangladesh (for processed wool only)
- Indonesia
- India
- Vietnam (for processed wool only).

4.3.1 Methodology

As outlined in the following sections, there are several potential mechanical and operational configurations available when designing a processing enterprise.

A range of publicly available published data sources were used to inform the various input and processing prices in international locations. These are detailed in 7.3 and include wages, energy and water.

The central Australian scenario was assumed to apply to other overseas locations to estimate the relative cost of processing overseas. In doing so, operational assumptions and parameters were unchanged across countries. As such, relative differences are a function of the difference in input prices.

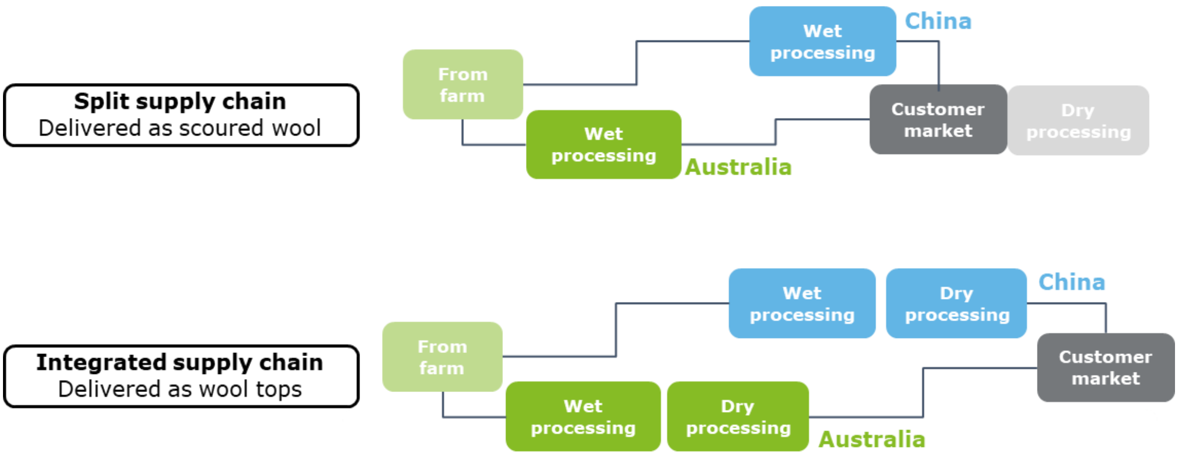
Other consumables consist mostly of traded goods. The prices for these goods are assumed to be the same in Australia and the other countries considered. Waste treatment costs were modelled using a bottom-up approach.[8]

In addition to production costs, the cost of delivering processed wool to a customer (i.e. a spinner or comber) includes costs incurred across numerous transport and regulatory steps. These costs have been incorporated into the modelling and include:

- raw wool prices
- tariffs
- road transport
- sea freight.

The cost of delivery from Australia to selected markets was compared to a supply chain that represents the status quo, where greasy wool is exported to China, before being processed either into scoured wool or through to tops before being exported to the priority market. These differing supply chains are shown in Figure 4.1.[9] In both supply chains it is assumed that once wool has been carded or combed, it is used in the local textile manufacturing industry. While other supply chain models exist,[10] the stylised supply chain described here represents that in the priority locations.

Figure 4.1: Stylised depiction of modelled supply chains, splitting wet and dry processing across countries or integrated within one country



Source: Deloitte Access Economics (2022).

The assumed price of raw wool, the applied tariff rates and transport costs are outlined below.

Raw wool prices

All processors were assumed to face the same raw wool cost. However, due to biosecurity import restrictions, Australian processors are limited only to Australian wools. Consultation with industry found that while this was an important aspect for commercial decision making, it was not likely to materially impact the cost of delivery to customer. In part, this is because single origin products have the potential to be marketed as such and deliver value-add opportunities. It also reflects the ability for spinners and later stage processers to blend single source top from other locations, and

[8] This approach is consistent with Zessner et al (2010)[8] who estimate wastewater treatment costs for a range of European countries.
[9] Similar supply chains estimates were developed for other selected markets with comparable results.
[10] For example, in Czechia or Türkiye where early-stage products are in large part exported after processing

that in recent periods, the cost of wool from Australia had become relatively cheaper compared to some locations.[11]

Tariffs

Included in this analysis are tariffs on Australian greasy wool exports to China, as well as tariff rates on clean wool and wool tops as faced by China and Australia in each of the selected markets. This includes a 1% tariff on greasy wool exports from Australia to China, that applies to wool imports that are then exported.[12]

Australia and China face similar tariff rates when exporting to the selected markets in scope for this analysis. Both countries have free trade agreements with Indonesia, Vietnam and South Korea and face the same applied rates for Czechia, Türkiye and Bangladesh.

Tariff rates applied by India are currently the same in China and Australia. However, there is an in-principal agreement for a Comprehensive Economic Cooperation Agreement (CECA) between Australia and India.[13] Given the CECA is yet to enter into force, the analysis applied two different tariff rates reflecting the current applied rates and those expected under the agreement.

Transport

Transport costs include several legs in Australia, China and overseas markets to transport from farm to port and then to mill. Sea freight includes an assumed single leg of sea freight if supplied directly from Australia, and two legs if scoured or processed to tops in China before being shipped to the customer in the selected country.

4.3.2 Results - international processing costs

All results are presented as costs relative to Australia, allowing for a simple comparison of international competitiveness. Chart 4.1 shows the relative cost of processing in Australia and overseas locations. Processing costs in Australia are estimated to be higher than all other selected countries. These results are consistent across both wet and dry processing activities and the woollen and worsted systems.

Scouring costs are estimated to be lowest in Indonesia and Türkiye. Bangladesh and Vietnam are estimated to have the lowest top making costs. Excluding South Korea and Czechia, scouring and top making in all the countries considered in the analysis is estimated to be at least half as costly as in Australia.

Estimated processing costs in Czechia are the most comparable to Australia but remain around 10 per cent lower in the worsted system, for example. Czechia's lower processing costs result from moderately lower water costs and wages (that are relatively advanced), which are partially offset by considerably higher energy costs.

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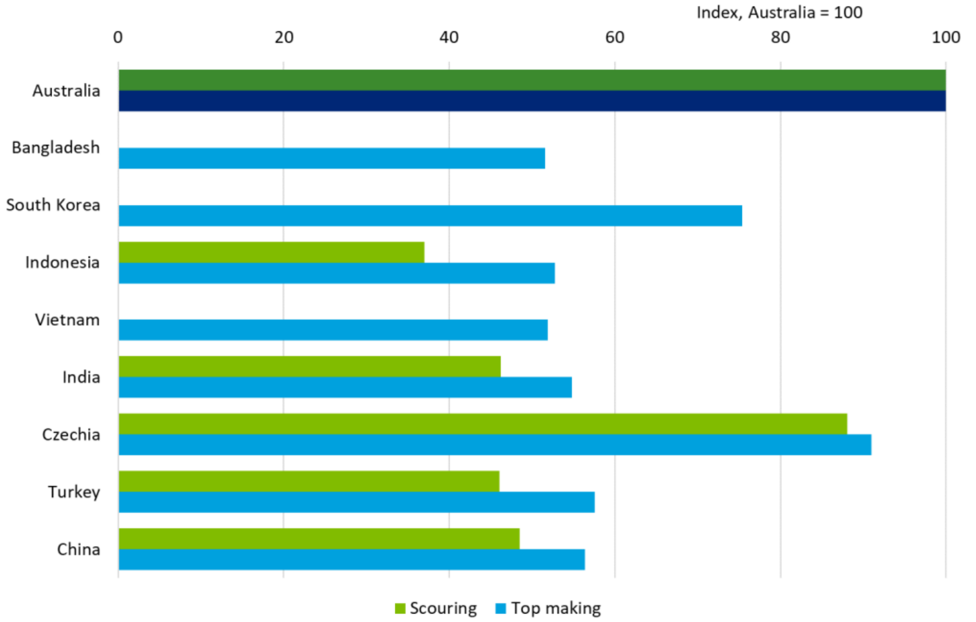
[11] According to Cape Wools SA, in the first 20 sales of the 2021-22 season, Australian 20um wool was selling US 131.9 cents per kilogram lower than South African wool,

[12] The one per cent reflects the tariff rate applied under WTO quota access. Sensitivity testing with a weighted average tariff rate across the WTO and ChAFTA quotas (0.9%) did not materially impact the magnitude or direction of results.

[13] See Appendix A for more detail on the slated Australia India FTA.

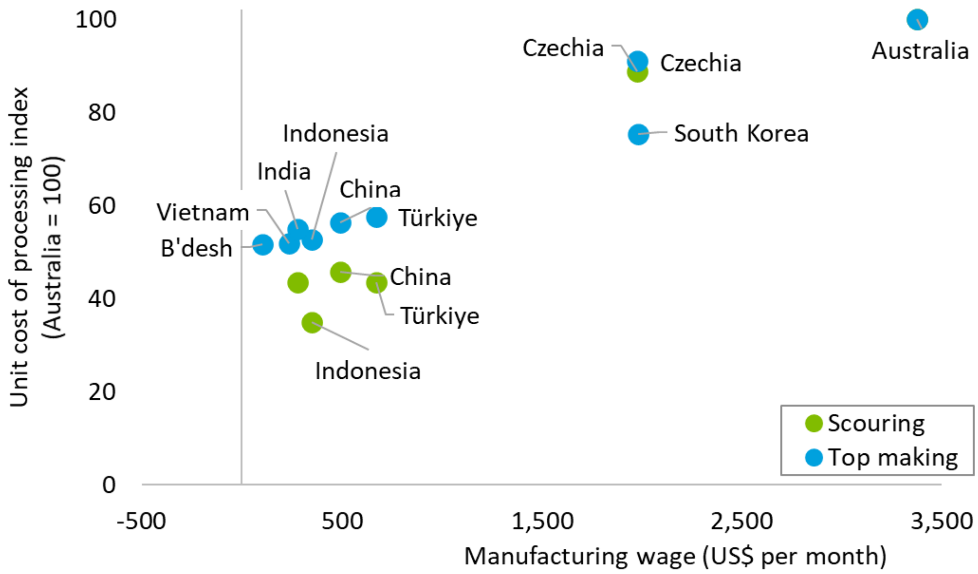
Chart 4.1: Cost of scouring and top making in selected countries, relative to Australia



Source: Deloitte Access Economics (2022).
Note: Scouring in Bangladesh, Vietnam and South Korea not in scope with industry advising local wastewater regulations are prohibitively restrictive for expanded wet processing.

The cross-country cost differences are largely explained by wages. Their importance is illustrated in Chart 4.2, which depicts the cost of processing relative to Australia for selected countries against reported manufacturing wages.[xxii] There is a strong positive relationship between manufacturing wages and the cost of processing relative to Australia. In Bangladesh, for example, manufacturing wages are estimated to be around US$104 per month, 3.1% of the average cost reported in the same survey for Australia (US$3,374 per month). This translates to processing costs in Bangladesh that are around half that in Australia for top making.

Chart 4.2: Relationship between relative cost of processing to Australia and manufacturing wages



Source: Deloitte Access Economics (2022) and Japan External Trade Organisation (2020).

Note: Scouring in Bangladesh, Vietnam and South Korea not in scope with industry advising local wastewater regulations are prohibitively restrictive for expanded wet processing.

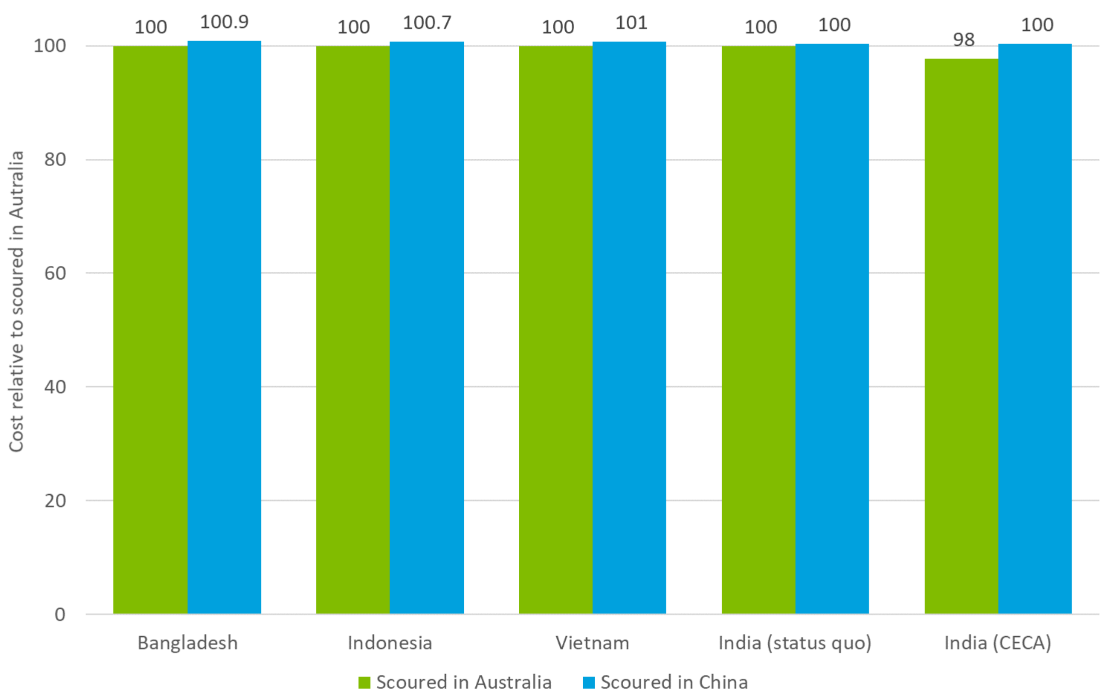
Lower water and electricity prices are also a factor. For example, electricity and water prices in Türkiye are around two-thirds and 25 per cent of those found in Australia, respectively.

4.3.3 Results – delivered cost to customers

As shown in Section 4.3.2, the cost of processing is significantly higher in Australia compared to the priority locations. However, this difference becomes negligible once it is incorporated into the total cost to deliver product to customers. The finding that processing costs are minor in the context of total delivered costs is consistent with previous research that found raw wool accounts for 53 per cent of the top making cost base.[xxiii]

Chart 4.3 shows that Australia can deliver scoured wool to selected markets cheaper than China. Under this scenario, dry processing takes place in the customer market. Australia is the most competitive when comparing scoured wool to Czechia where Australia is assessed as around 6.4 per cent cheaper than a supply chain that goes through China. More modest delivered cost advantages are modelled for Indonesia and India, where scouring in Australia is estimated to be around 1 per cent cheaper than if shipped through China for scouring.

Chart 4.3: Cost delivered to customer in selected countries, if scoured in Australia or China



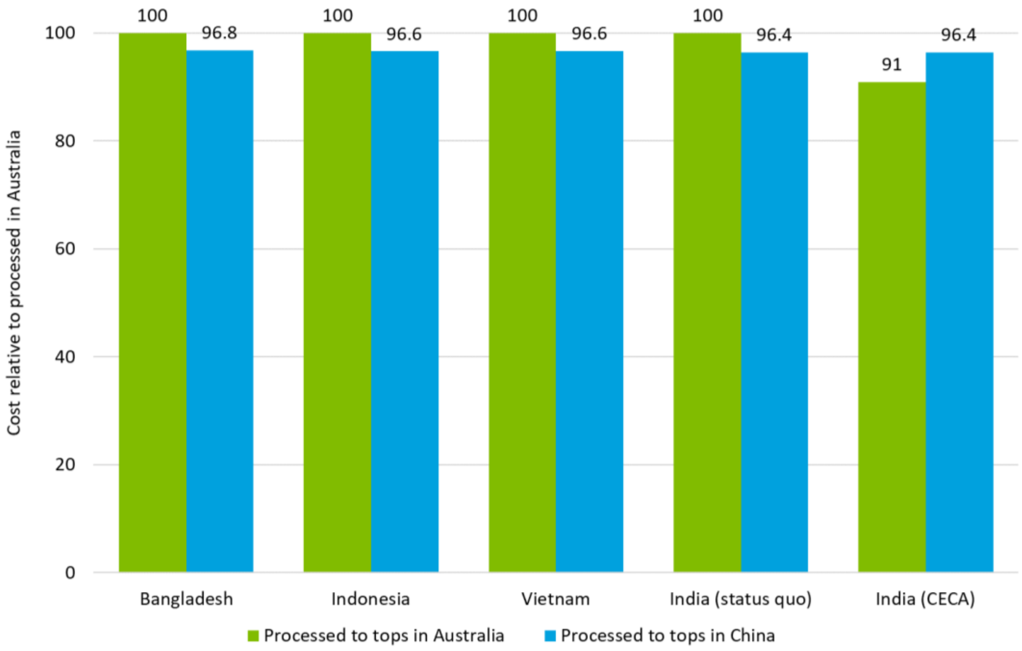
Source: Deloitte Access Economics (2022).

Note: Wet processing in Bangladesh, South Korea and Vietnam not in scope.

Importantly these cost advantages or disadvantages are relatively minor. Given the estimates are underpinned by a range of sensitive data inputs and broad-based assumptions, the results demonstrate that Australia is broadly competitive in terms of cost of delivery more than anything else.

Similar broadly competitive results are found for full early-stage processing, although Australia's higher labour costs do result in a general cost disadvantage. Processing through to tops in Australia (when measured at the delivered to customer stage) is relatively more expensive than the status quo (Chart 4.4). The cost difference is again modest but consistent with processing to tops in Australia assessed as around 3 per cent more costly across the selected markets. This result mainly reflects the higher labour costs involved in processing, although is it partially offset through gains from lower transport costs.

Chart 4.4: Cost delivered to customer in selected countries, processed to tops in Australia or China



Source: Deloitte Access Economics (2022).

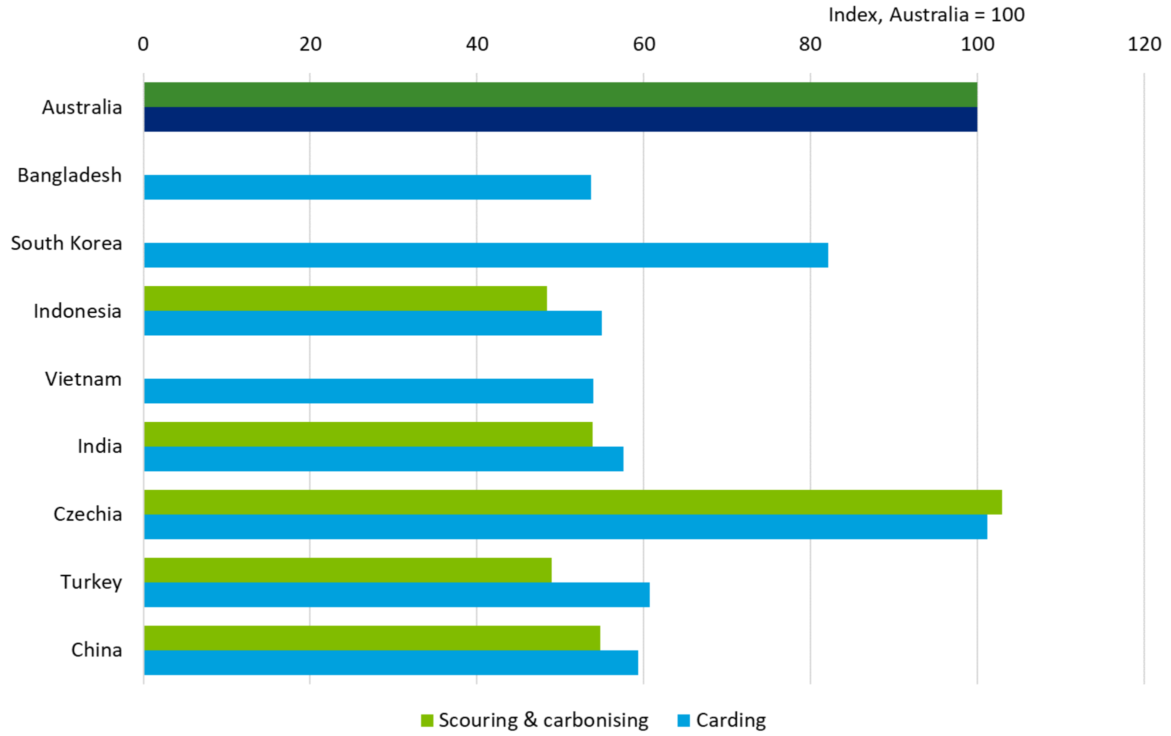
While currently more expensive, the results also show that Australia has the potential to deliver wool tops to India at a lower cost than the status quo. This is if the current tariff charges are reduced as expected through the introduction of the CECA.

Woollen system

The results in the above section are generally consistent with an enterprise involved in woollen processing. The cost of production in Australia is higher than all selected priority locations except Czechia (Chart 4.5). However, once included in the total delivered cost, the difference is minimal. Similar to the worsted system, Australia is estimated to be approximately 1 per cent less expensive when delivering scoured wool to the priority locations compared to the current supply chain (Chart 4.6).

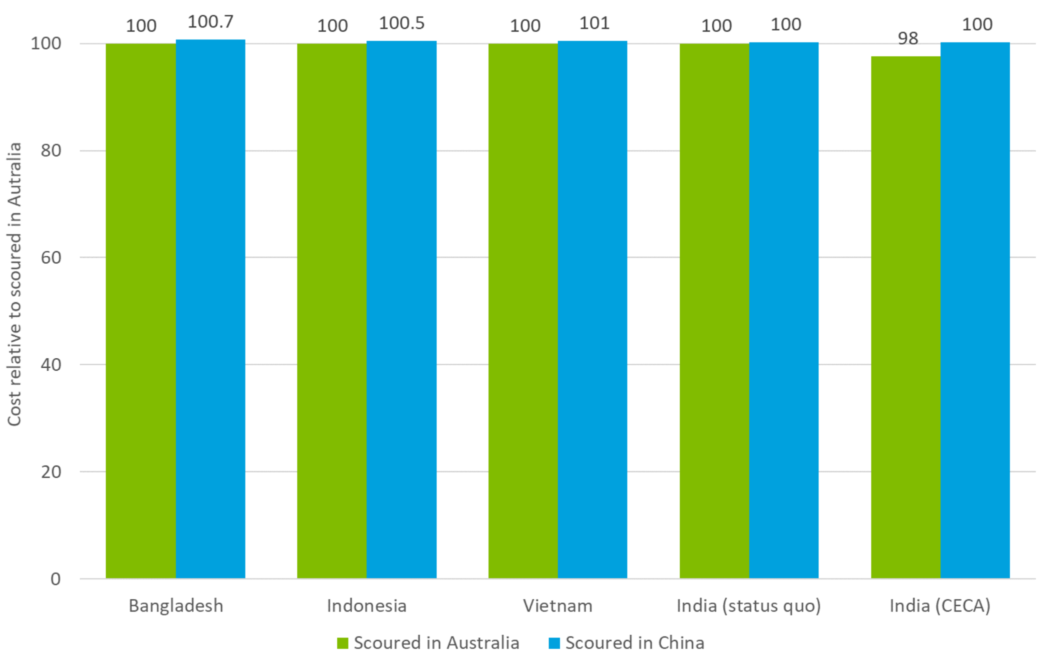
As with the worsted system results the cost advantages and disadvantages of the woollen system are relatively minor. Given the estimates are underpinned by a range of sensitive data inputs and broad-based assumptions, the results demonstrate that Australia is broadly competitive in terms of cost of delivery more than anything else.

Chart 4.5: Cost of scouring and carbonising and carding in selected countries, relative to Australia, woollen system



Source: Deloitte Access Economics (2022).

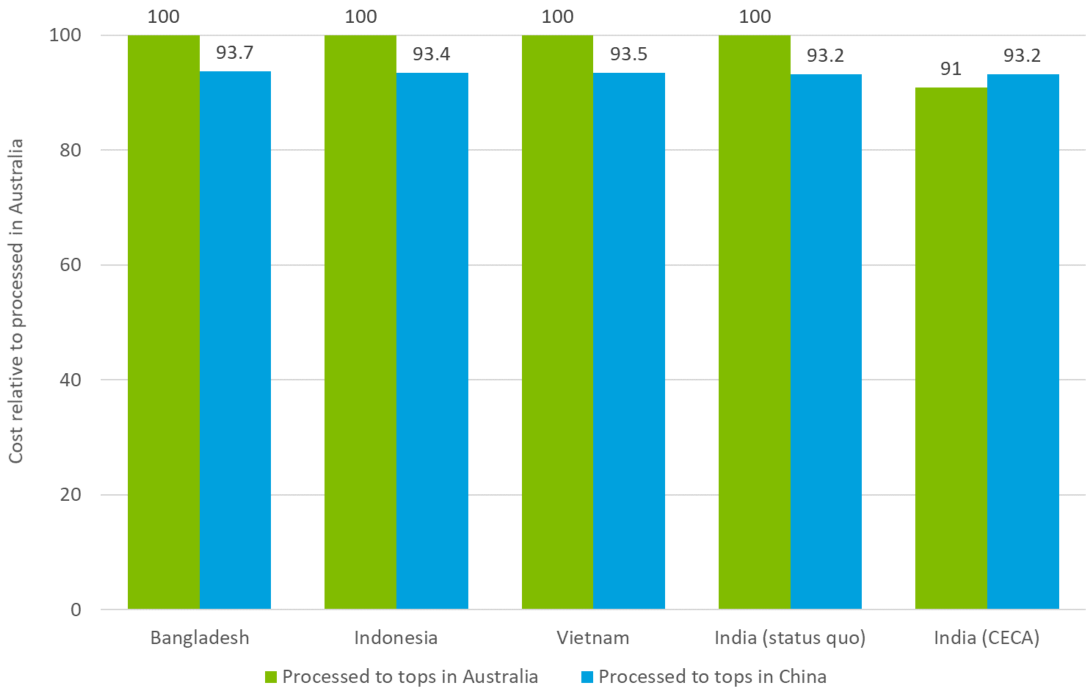
Chart 4.6: Cost delivered to customer in selected countries, scoured in Australia or China, woollen system



Source: Deloitte Access Economics (2022).

In the case of full domestic early-stage processing through to carded wool tops (Chart 4.7), Australia is estimated to be approximately 5 per cent more expensive than the equivalent product delivered to international customers from China.

Chart 4.7: Cost delivered to customer in selected countries, processed to carded wool tops in Australia or China, woollen system



Source: Deloitte Access Economics (2022).

4.3.4 Diversifying greasy wool exports

In addition to diversifying trade through the development of early-stage processing capacity, this analysis also considers the potential for diversification through increased exports of greasy wool to novel markets. Of the locations considered for diversified processed wool trade, only a subset were considered for greasy exports. This is because some locations (namely Bangladesh, Vietnam and South Korea) have prohibitively restrictions on wastewater generation, constraining the ability for local scouring and carbonising to be developed.

A comparison of scouring costs across each of the locations is outlined in Chart 4.5. This modelling demonstrates that scouring costs vary widely across locations and is closely related to in-country labour costs. While locations such as Czechia, Indonesia, and Türkiye might provide commercially competitive opportunities for greater greasy trade, there are assessed to be significant non-financial constraints to growth.

In India, for example, wastewater regulations have increased substantially since 2014, creating considerable uncertainty for wet processing of wool. Advice provided during consultation indicated several firms had imported scouring capital in recent years but regulatory uncertainty had stalled their installation. This policy environment in part explains the steady decline in Indian greasy wool imports with, for example, the volume of imports in 2018 reduced by around two-thirds when compared to 2014.[xii] Similar policy environments exist in Indonesia with respect to waste water and when combined with limited historical trade in greasy wool to date, there is reasonable uncertainty around the potential for trade to expand in the future.

In the northern hemisphere, both Czechia and Türkiye are expected to see strengthened wastewater regulations driven by broader EU environmental and sustainability policies. The market structure in Czechia is also not assessed as being positioned to facilitate expansive growth, with the local wool scouring industry relatively mature and highly concentrated (with one main large scourer; see Appendix A for more detail).

This scan of the regulatory and business environments of each country shows that relying on an export diversification strategy alone is highly uncertain and would be unlikely to be sufficient to accept the 170 million kilograms of greasy wool that is scoped for this report. Further, greasy trade may not provide the advanced risk management that local scouring could against a FMD outbreak (discussed in Section 5).

4.3.5 Gains from transport efficiency

While the cost of processing in Australia is comparatively higher than in most other countries, supply chain efficiencies can offset much of this impact. This is outlined in Chart 4.8 which describes estimated sea freight costs for processed wool to selected markets when shipped direct from Australia or via China. For most markets, removing one transport leg and shipping direct from Australia is comparatively cheaper than shipping via China. This is despite Australia facing very low-cost shipping rates to China that leverage backloading opportunities.

The cost differential ranges from 20 per cent (India) to 80 per cent (Türkiye) and is largely a function of the addition of a second transport leg, and that leg consisting of shipping costs ex. China. For many countries, shipping from China is relatively costly and this is a significant contributor to the differences in supply competitiveness estimated here.

When comparing direct trade of greasy and clean wool with overseas locations, similar costs are estimated. Greasy costs, per kilogram are higher, due to the added non-wool matter in individual consignments (estimated to be around 30% of the exported weight). Greasy exports to these locations are also estimated to be higher than when compared to the status quo (greasy trade with China) due to the status quo .H

In addition to efficiencies in transport, supply chains that are directly sourced from Australia are also modelled to observe a one per cent[14] gain in price competitiveness by avoiding the tariff applied on Australian greasy wool exports to China.[15]

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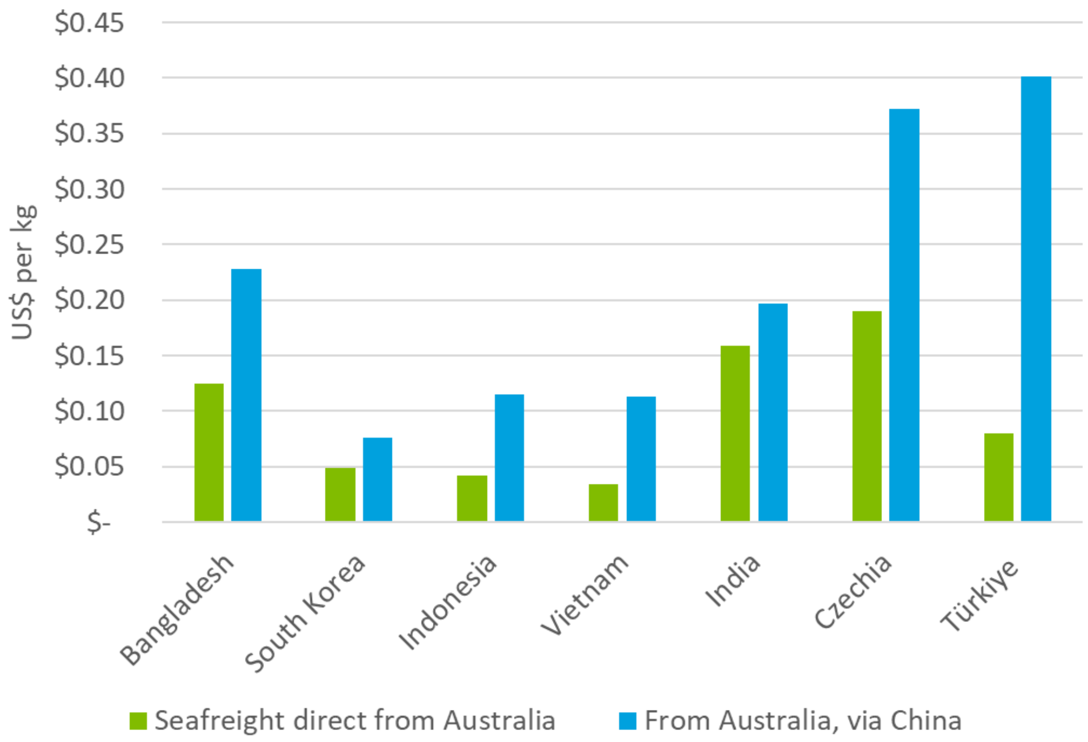
[14] The one per cent reflects the tariff rate applied under WTO quota access. Sensitivity testing with a weighted average tariff rate across the WTO and ChAFTA quotas (0.9%) did not materially impact the magnitude or direction of results.

[15] This analysis also considers gains to transport efficiency from shipping greater volumes of processed wool across a containerised cost base. However, this effect is assessed as small to negligible as China's scoured or wool top exports are assumed to be shipped in similar volumes. The transport efficiency gains are only realised when compared to greasy exports and this is a relatively small share of the cost for supply chains that go through China.

Chart 4.8: Estimated sea freight cost per clean kilogram delivered to selected markets, either direct from Australia or via China



Source: Deloitte Access Economics (2022).

The estimated cost delivered to customer outlined in this section shows Australia is broadly competitive for scouring and more expensive for top making. However, the size of the cost differential is uncertain and influenced by both the cost of processing estimates (including the assumed central scenario and variation in input prices) as well as transport costs.

Nevertheless, these findings illustrate that Australia could be broadly competitive with the supply chain status quo. This is the case because transport efficiency gains to selected markets are currently significant enough to offset Australia's estimated higher cost of processing. Sensitivity analysis of key parameters is provided in Appendix B.3.

5 Risk scenario analysis

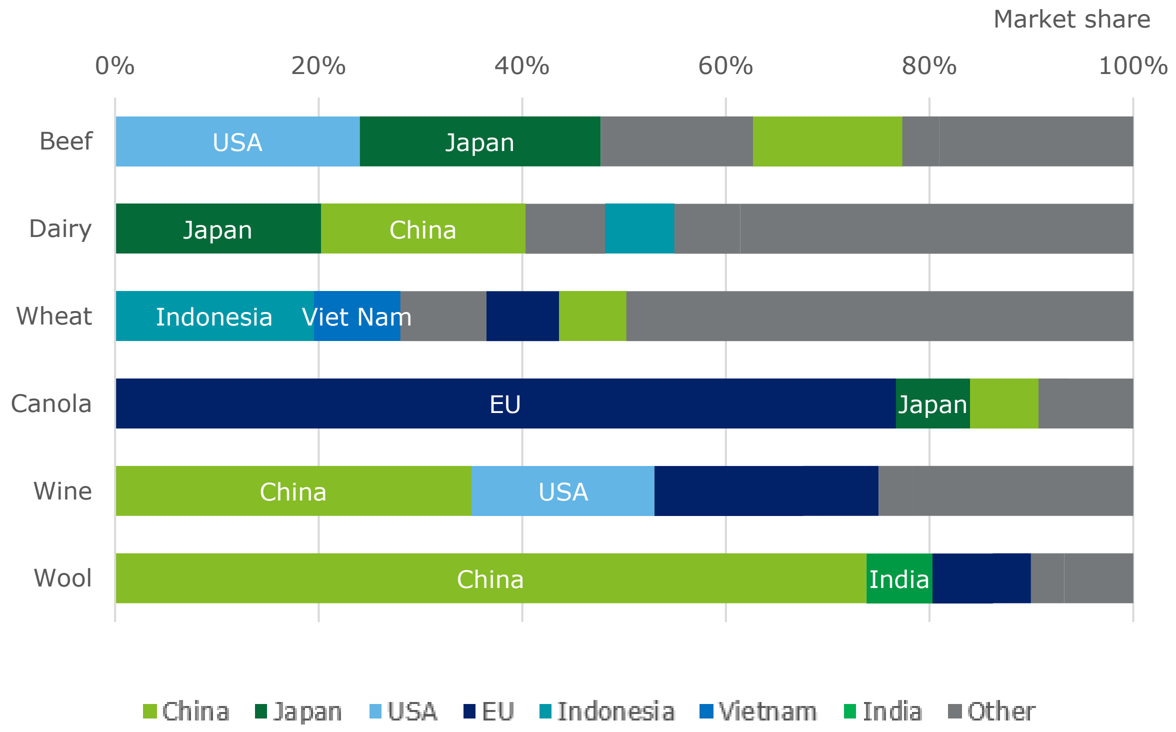
The wool industry is exposed to an array of risks that would have economic and social impacts, including animal disease outbreaks and trade barriers. Increasing the presence of early-stage processing in Australia could help mitigate these risks.

5.1 Introduction

Australia's wool supply chain has, to date, been relatively effective in meeting strong consumer demand. Virtually all wool is exported from Australia, compared with most other agricultural products (where around 70 to 75% of production is exported on average) meaning wool is in a broad sense more exposed to global market risks.

The integration of Australian wool into global processing and textile markets has also developed alongside a concentration in a select few markets. Around 80% of Australian wool is exported to just two countries, and of that, China accounts for the bulk of trade (Chart 5.1). This contrasts with most other commodities, with the top markets for Australian beef, dairy, wheat and wine accounting for between 35% (wine) and 20% (dairy and wheat).[16]

Figure 5.1: Value share of four largest export markets, 3-year average to 2020



Source: UN Comtrade (2022).

[16] Australian canola is similarly concentrated to wool, with the EU and Japan taking a comparable share of Australian exports. However, canola also supplies the domestic market with around 25% of production remaining in Australia for consumption.

This section analyses how greater early-stage wool processing in Australia could be expected to alter the impact of specific risks in the event they occur. The specific risks analysed here include:

- changes to tariff regimes
- changes to non-tariff measures on the Australian wool industry, and
- a stylised animal disease outbreak in Australia.

The potential for early-stage processing to alter the impact of these risks is analysed in Deloitte Access Economics' Computable General Equilibrium model (DAE-RGEM; see Section 7.3 for more detail). Each risk scenario is analysed by comparing a base case that represents the status quo against a policy scenario where greater early-stage processing is undertaken, with the specific risk modelled to occur in each scenario. The specific risk scenarios are outlined in the following sections with early-stage processing modelled to account for peak processing capacity of 170 million kilograms per annum.

5.2 Changes to tariffs on greasy wool

Access to international markets is regulated by various governments using an array of mechanisms. Historically, tariffs (taxes levied on specific commodities at the importing border) are central mechanisms for governments to regulate trade. In general, global tariff rates have steadily declined following the Uruguay Round Agreement in 1995 with liberalisation further supported by an array of bilateral and multilateral free trade agreements (FTAs).

The current structure of Australian wool exports, mean trade currently faces relatively modest tariff rates as demonstrated in Table 5.1. However, the classification of different wool products into agricultural (i.e. greasy wool) and manufactured items (i.e. scoured, carbonised, carded or combed wool) means that rates are variable.

Table 5.1: Summary of applied tariffs for Australian greasy wool

	Tariff rate (%)				
Importing country (applicable trade agreement)	**Greasy**	**Scoured**	**Carbonised**	**Carded**	**Combed**
Bangladesh	5	5	5	5	5
China (China-Australia FTA)	1[17]	0[18]	0[18]	0	0
Czechia	0	0	0	2	2
India (IA-CETA)	5	5	5	5	7.5-10
Indonesia (IA-CEPA)	0	0	0	0	0
Korea, Republic of (Korea – Australia FTA)	0	0	0	0	0
Türkiye	0	0	0	2	2
Vietnam (ASEAN – ANZ agreement)	0	0	0	0	0

Source: WTO (2022).[xxiv]

[17] The tariff rate is an average cross both the WTO and ChAFTA rates. Within a WTO tariff rate quota of 287,000 tonnes, 37.5% out of quota tariff. Under the ChAFTA, the tariff rate quota is increasing from 40,000 metric tons to 44,000 metric tons in 2024, with a 38% out of quota tariff.
[18] In addition to the existing WTO quota, Australia received an exclusive duty-free Country Specific Quota under ChAFTA. This quota provides access at duty-free rates and has increased annual since 2018 by 5% per annum reaching 44.3 million kilograms in 2024.

Governments can adjust tariff rates relatively easily altering the competitiveness of commodities or suppliers. This was demonstrated in May 2020 when China imposed a tariff of 80.5% on Australian barley exports, which was followed in March 2021, by anti-dumping duties on Australian wine of between 116.2% and 218.4%.[xxv,xxvi] Similarly, between January 2018 and 2020 tariffs imposed during an escalating trade between the United States and China saw increased tariffs on imports of 15.3% and 14.7% respectively.[xxvii]

This section analyses the impact to the Australian wool supply chain were increased tariffs imposed on Australian greasy wool exports using two case studies and the potential for early-stage processing as a risk mitigating strategy.

5.2.2 Methodology

The effect of greater early-stage processing in Australia in mitigating the risk of increased tariffs is modelled in Deloitte's in-house computable general equilibrium (CGE) model. A baseline scenario is compared to a policy scenario, both of which are described in the following sub-sections.

5.2.2.1 Tariff increases: baseline scenario

Similar to an emergency animal disease event, in the baseline scenario, Australia's wool supply is assumed to remain focused on greasy wool exports to China in line with the existing supply chain. In both the baseline and policy scenarios, stylised tariffs are assumed to be imposed on Australian wool exports. Two separate baseline tariff increases are modelled to represent the array of possible tariff increases.

- A tariff of 14.7% is applied to Australia's greasy wool exports in line with that imposed during the US-China trade war. This tariff is however assumed to be removed gradually over 6 years.
- A tariff of 80.5% is applied to Australia's greasy wool exports and is assumed to remain in place for the modelled horizon (to 2050).

5.2.2.2 Tariff increases: policy scenario

In the policy scenarios, both sets of tariff increases are individually modelled to occur. In the policy scenario an expansion in early-stage processing in Australia and concurrent export market diversification is assumed, driven by export demand. It is assumed that at peak capacity, half of current exports are diverted into early-stage processing in Australia and subsequently exported to diversified export markets (representing trade of around 170 million kilograms greasy).

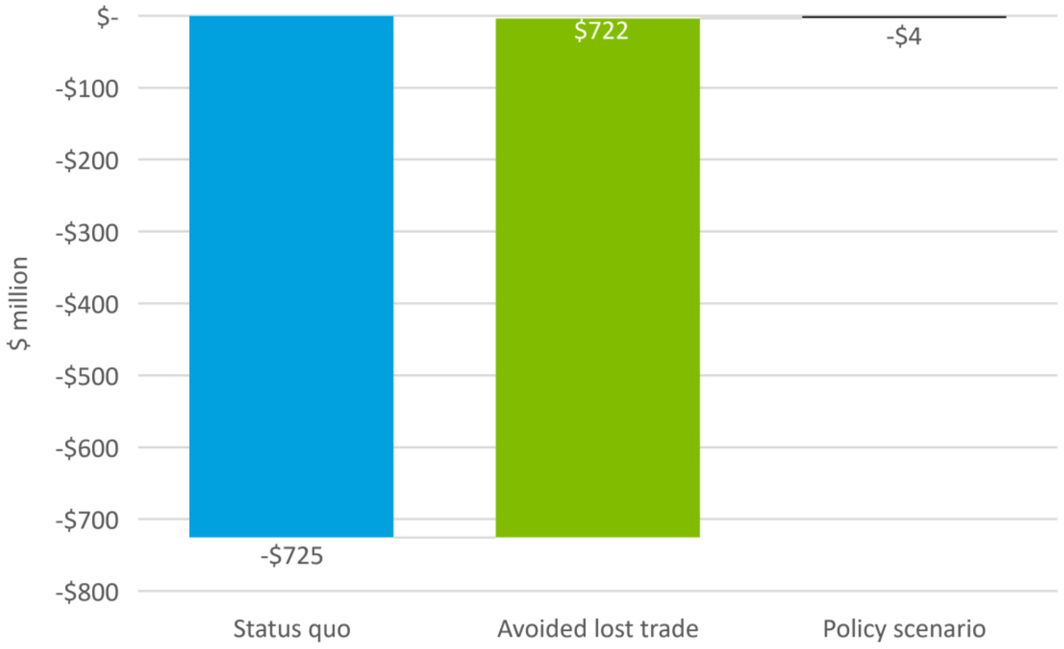
5.2.3 Results

The estimated impact to the wool industry of introduced tariffs on greasy exports is outlined in this section, including a stylised supply chain with greater early-stage processing undertaken in Australia and resultant diversified export markets. The modelling demonstrates that reductions in wool industry output are at least partially offset by early-stage processing and diversified export markets if tariff increases are observed in a single export market.

Chart 5.1 describes the net impact to wool output from greater early-stage processing in 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.

In the policy scenario, greater early-stage processing is estimated to offset much of the impact to industry output in affected years. During this period, Australian wool output is estimated to be $4 million per annum lower as a result of the tariff increase. Comparing the baseline and policy scenarios yields a net impact to industry output that peaks at $722 million.

Chart 5.1: Peak impact on wool output with greater early-stage processing and a 14.7% tariff on greasy wool exports

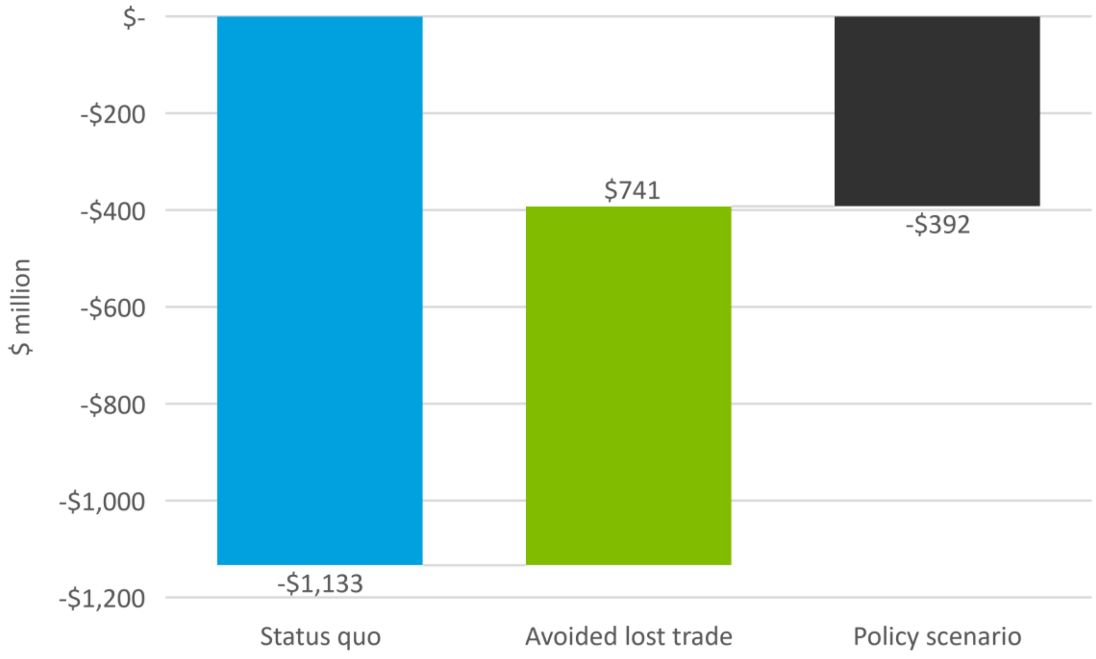


Source: DAE-RGEM (2022).

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. Between 2037 and 2050, even with early-stage processing, an 80.5% tariff on greasy wool exports is estimated to leave wool output 11.9% lower or $392 million per annum in the peak impacted year.

Chart 5.2: Peak effect on wool output of greater early-stage processing with an 80% tariff applied to greasy wool exports



Source: DAE-RGEM (2022).

5.3 Changes to non-tariff measures

Non-tariff measures (NTMs) encompass a range of regulatory measures, being broadly defined as measures applied to traded goods, other than tariffs.[xxviii] The use of NTMs has grown substantially in recent years, in contrast to the declining use of tariffs (Nicita & Gourdon 2013).[xxix] While most NTMs are indiscriminate, an estimated 11% of agricultural measures are origin specific.

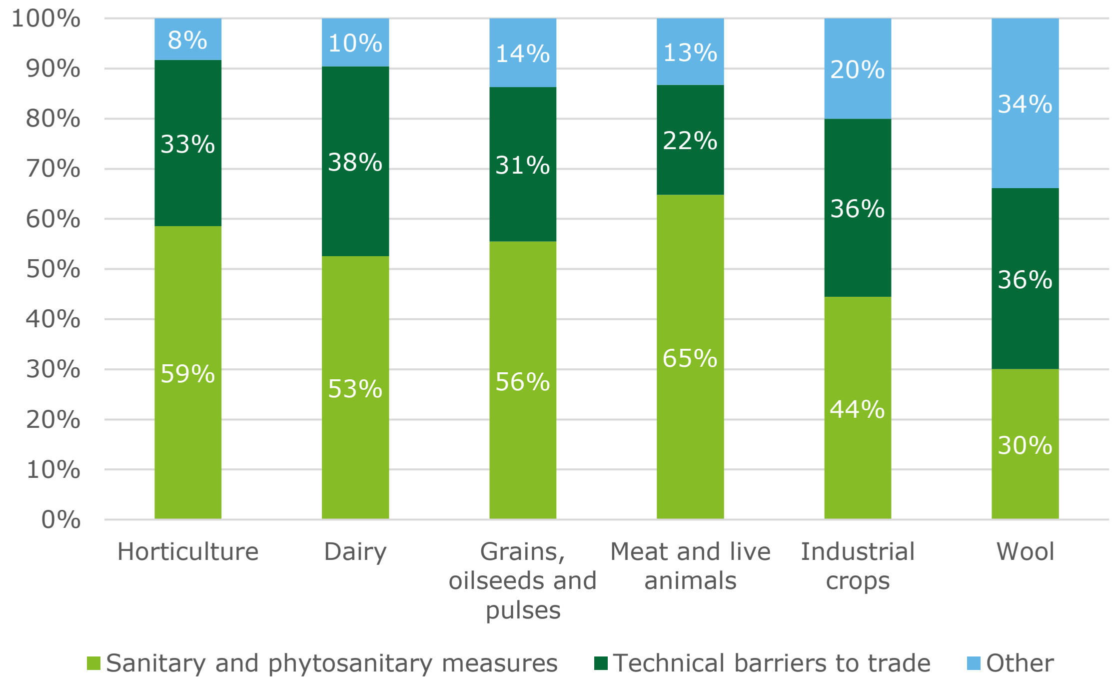
Wool is a unique commodity unlike most other traded goods with a relatively limited number of applied NTMs. In 2019, 709 NTMs were applied to Australian wool, compared with between 3,558 and 3,870 for meat, grains or dairy and 6,900 for horticulture products (Chart 5.3).

Moreover, wool faces different types of NTMs than other commodities. For most Australian exports, Sanitary and Phytosanitary (SPS) controls account for around half of NTMS. For Wool, SPS measures account for only 30% of measures, while technical barriers to trade (TBT) account a further third of measures. SPS measures impose biosecurity, health and food safety requirements while TBT measures include for example, labelling and certification requirements or information pertaining to product origin or importer.

Reflecting the array of possible measures, NTMs can have varied effects on supply chains and trade. The economic literature broadly considers two main effects including on prices and on traded volumes.[19] In line with these broad categories, this section examines the impact of two sets of stylised of NTMs.

[19] 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>

Chart 5.3: Non-tariff measures applied to Australian agricultural exports, by commodity



Source: ABARES (2019).

5.3.2 Methodology

The effect of greater early-stage processing in Australia in mitigating the risk of increased non-tariff measures is modelled in DAE-RGEM. Two sets of NTMs are considered, covering both price and volume effects. Individual baseline and policy scenarios are modelled and described in the following sections.

5.3.2.1 Price effect NTM: baseline scenario

In this baseline, Australia's wool supply is assumed to remain focused on greasy wool exports to China in line with recent historical trends. A price affecting NTM on Australian greasy wool exports is assumed to be introduced. This NTM is a stylised representation of regulatory controls in the importing country that impose additional cost such as enhanced certification requirements. The relative price impact is stylised as a 1.0% increase on the cost of exporting wool that is retained to 2050 once introduced. The stylised increase 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.[xxx,20]

5.3.2.2 Quantity effect NTM: baseline scenario

In this baseline, Australia's wool supply continues to be focused on greasy wool exports to China in line with existing trends trade. A quantity affect NTM is assumed to be introduced on Australian greasy wool exports that completely restricts export access to a specific market. This NTM is a stylised representation of regulatory controls such as biosecurity controls which restrict imports with pests, disease or contain risky extraneous matter. The restriction to greasy market access is assumed to be maintained for 5 years and is assumed not to apply to processed wool or trade with greasy wool trade with other markets than that which imposes the NTM control.

5.3.3 Results

The estimated impact to the wool industry of introduced NTMs on greasy exports is outlined in this section, including a stylised supply chain with greater early-stage processing undertaken in

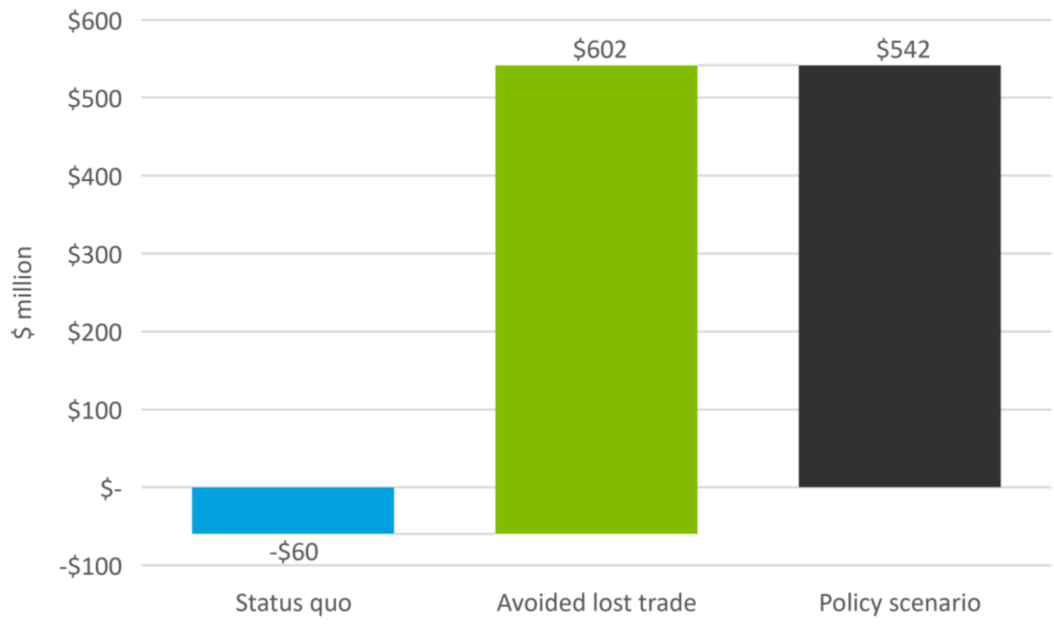
[20] The price NTM is assumed to be introduced in 2035.

Australia. The modelling demonstrates that reductions in wool industry output are at least partially offset by early-stage processing if non-tariff barriers strengthen on greasy wool exports.

Given the scenario outlined in detail in Section 5.3.2.1 above, Chart 5.4 describes the net impact to wool output from greater early-stage processing in the event of price increasing NTMs. In affected years, the measures are estimated to reduce Australian industry output by 1.8% on average, equating to around $60 million per annum during the affected period.

In the policy scenario, greater early-stage processing is estimated to more than offset the impact to industry output in affected years. Between 2023 and 2050, Australian wool output is estimated to be $602 million per annum in the peak affected year reflecting in part the demand led assumed increase in processing output. Comparing the baseline and policy scenarios yields a net impact to industry output of $542 million per annum (or around 20% of current output).

Chart 5.4: Impact on wool output with greater early-stage processing and a price affecting NTM applied to greasy wool exports

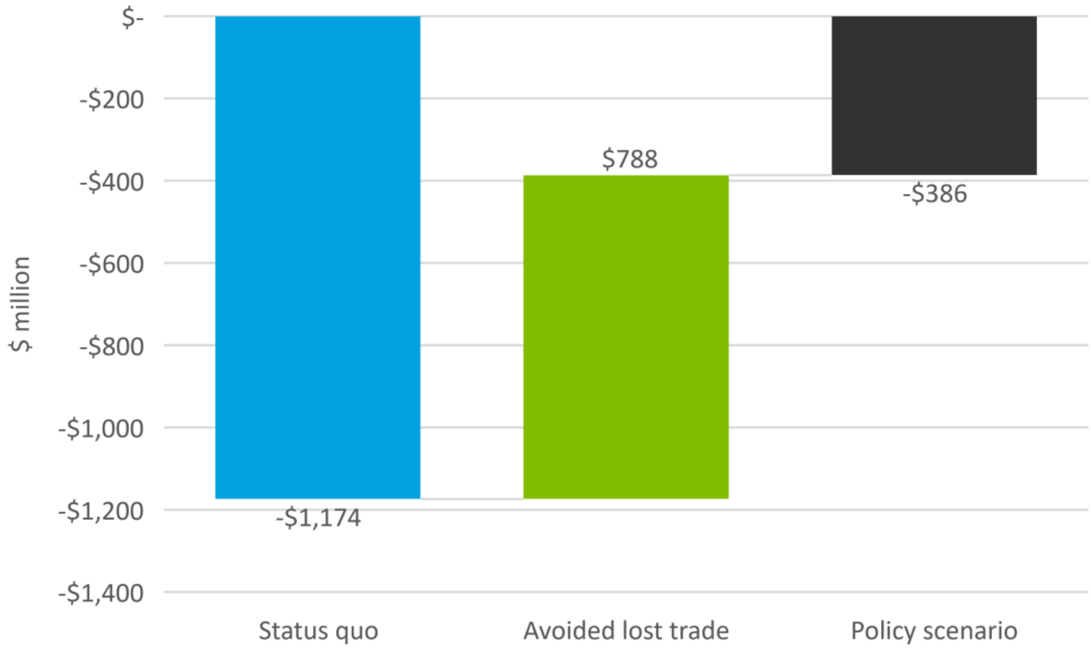


Source: DAE-RGEM (2022).

Given the scenario outlined in detail in Section 5.3.2.2 above, 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. Chart 5.5 shows that in 2037, when the NTM is imposed, wool output is estimated to decline by around 51% or $1.2 billion per annum.

The introduction of early-stage processing offsets some of this lost output, however given the magnitude of lost trade the policy scenario still results in a lower output for the Australian wool industry. During the affected period, greater early-stage wool processing alongside a permanent loss of market access for greasy wool exports results in Australian wool output being 11.5% lower on average, equivalent to $386 million per annum.

Chart 5.5: Peak effect on wool output of greater early-stage processing and a quantity affecting NTM applied to greasy wool exports



Source: DAE-RGEM (2022).

5.4 Emergency animal disease event

Agricultural production is susceptible to a range of pests and diseases that can affect yields and quality and introduce human health and animal welfare risks. Global trade in agricultural products has the potential to spread these risks and as such is regulated by governments around the world.

Trade in animal products is often of particular concern given the visible toll it can sometimes take on animal welfare. One disease that is of central concern is foot-and-mouth disease (FMD), a highly contagious disease that affects cloven hoofed animals (i.e., sheep, cattle, goats and pigs). Wool, as a globally traded animal product, is susceptible to animal disease outbreaks and resultant government control measures.

This section examines the impacts of a larger early-stage processing industry in Australia in the event of an animal disease outbreak such as FMD.

5.4.1 Methodology

The effect of greater early-stage processing in Australia in managing exposure to an animal disease outbreak is modelled, by comparing a baseline scenario against a policy scenario. These two scenarios are described in the following sub-sections.

5.4.1.1 FMD baseline scenario

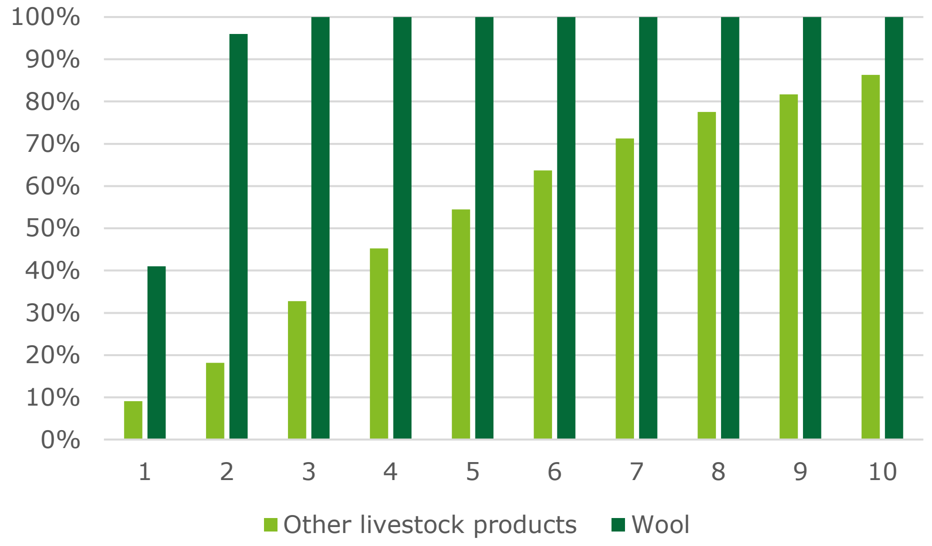
In the baseline, Australia's wool supply is assumed to remain focused on greasy wool exports to China in line with recent historical trends. In the baseline (and policy) scenario an FMD outbreak is assumed to occur. The FMD outbreak is represented in the CGE framework by a series of shocks to the livestock sector (including wool). These shocks are informed by modelling from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) (2013)[xxxi,21] and include reduced market access, capital costs and control costs following a large FMD outbreak.

Loss of market access is assumed to follow the path described by ABARES (2013; Chart 5.6) in which a large outbreak restricts wool exports to approximately 44 per cent of the baseline in the first year and 96 per cent in the second. Wool exports are expected to recover to 100% by the

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

third year following the outbreak. As shown in the chart below, this is a faster recovery than is assumed for other livestock products.

Chart 5.6: Share of pre-outbreak exports in years after outbreak



Source: ABARES (2013).

It is also assumed that the Australian government and industry are required to rapidly destroy and dispose of significant numbers of livestock to control the spread of FMD.[22] Lastly, it is assumed additional control costs are required of industry to manage the treatment and recovery of the animal disease outbreak. This principally includes vaccination regimes, and involves various costs associated with implementing such control costs.[23]

5.4.1.2 FMD policy scenario

In the policy scenario, the same FMD outbreak is assumed to occur as in the baseline, but greater early-stage processing is undertaken in Australia. Here the wool supply chain is modelled in line with that presented in Section 6.2, namely an increase in output in the order of 170 million tonnes (greasy) per annum. The impacts from FMD are applied either on farm, or to greasy wool market access with market access for scoured wool assumed not to be affected in line with WOAH guidelines.

5.4.2 Results

A stylised animal disease event in Australia is estimated to have a significant impact on wool output. Under a status quo supply chain, where exports are focussed on a single FMD sensitive market, FMD is projected to result in wool output being $1.2 billion lower on average per annum. This result is marginally higher than that for the permanent quantity NTM and reflects the similarity in outcomes for the export supply chain. 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.

In the policy scenario, greater early-stage processing is estimated to offset some of the impact to industry of the FMD outbreak. In the peak affected year, Australian wool output is estimated to be $953 million lower on average, around $1.1 billion above that without early-stage processing. This

[22] Following the methodology of ABARES (2013), it is assumed here that 0.2% of livestock animals are destroyed. In a CGE framework, this is introduced as a shock to the sheep industry's capital productivity (where livestock are assumed to account for approximately 7.1% of capital assets). The loss of capital productivity is assumed to be abated over time, with sheep returning faster to the baseline than other livestock industries, reflecting faster gestation periods.
[23] Greater control costs are introduced as industry wide productivity shocks to sheep and other livestock industries. For both the wool and other livestock industries, productivity is assumed to be -0.063% lower.

net increase reflects the assumed ability of early-stage wool processing to maintain open trade and support demand for wool.

Chart 5.7: Peak impact on wool output with greater early-stage processing and an FMD outbreak

Source: DAE-RGEM (2022).

6 Economic impact of developing early-stage processing in Australia

Expanding early-stage processing in Australia would have significant benefits for the economy. An increase of 170 million kilograms could increase Australian GDP by up to $1.8 billion and lift employment by 582 full time equivalent jobs between 2023 and 2050.

Increasing the capacity of the Australian industry to process more wool will have a significant impact on the wool supply chain, but also the Australian economy more broadly. This section uses the firm level estimates of Section 3 to analyse how different levels of processing in Australia would impact other parts of the economy.

6.1 Methodology

The impact of expanding Australia's early-stage wool processing capacity has been estimated in a computable general equilibrium (CGE) framework using Deloitte's in-house CGE model: DAE-RGEM (Deloitte Access Economics Regional General Equilibrium Model). DAE-RGEM encompasses all economic activity – including production, consumption, employment, taxes and trade – and can run scenarios through time involving multiple industries, occupations and regions. More detail on DAE-RGEM is provided in 7.3, alongside the specific model aggregation developed for this analysis.

The economic impacts of increasing early-stage processing of wool in Australia have been estimated by comparing selected policy scenarios, against a base case. Here the base case represents that status quo, where Australia's wool supply chain is focused on greasy wool exports that are largely shipped to China. The policy scenarios considered in this analysis include two possible alternate supply chains for Australian wool, namely:

- Wet scenario – representing the expanded capacity of worsted scouring or a woollen scouring and carbonising enterprise
- Early-stage processing scenario – representing the expansion of capacity of either fully integrated woollen or worsted processing capacity.

For both scenarios, it is assumed that all new processing capacity is established from greenfield sites and that effectively all output is exported. Reflecting the potential paths with which processing could potentially expand in Australia, this analysis considers three cases (low, medium and high) of potential industry expansion.

The modelling is undertaken over a 28-year horizon between 2023 to 2050. New processing output is assumed to come online in 2025 and follow a stylised s-curve path where initially output grows modestly before more rapid growth that eventually begins to taper as peak production capacity is reached after 10 years. The associated capital investment is assumed to be spread evenly in the first 5 years of the horizon.

The information used to inform the policy scenarios is based on the enterprise level estimates presented in Section 3. Industry wide figures are obtained by scaling the enterprise level estimates by increasing levels of annual throughput. The largest increase modelled here represents the share of Australian wool that is understood to be exported from China after processing (170 million kilograms), with the low and medium scenarios proportional shares of the high scenario (and presented in Appendix D. The specific capital investment and direct employment uplift from expanded processing capacity is outlined in Table 6.1.[24]

Under the high case, early-stage processing is estimated to require $1,119 million in capital investment and directly[25] employ 1,293 FTE positions. The high case of the wet processing scenario is comparatively smaller as a result of the smaller scope of activities undertaken. Here, $567 million in capital is required alongside 631 FTE jobs.

Table 6.1: Summary of key policy scenario input parameters

	Units	Low	Medium	High
Greasy wool throughput	million kg (annual peak)	42.5	85.0	170.0
Wet processing				
Capital investment	$ million (total, undiscounted)	142	284	567
Direct jobs	FTE jobs (annual peak)	158	315	631
Early-stage processing				
Capital investment	$ million (total, undiscounted)	280	560	1,119
Direct jobs	FTE jobs (annual peak)	323	647	1,293

Source: Deloitte Access Economics (2022).

Note: Capital investment excludes land purchases.

6.2 Economic impact analysis

The development of further early-stage processing in Australia is projected to have a significantly positive impact on Australia's economy, not just the wool industry. This section outlines these impacts on Australia's economic growth (via Gross Domestic Product: GDP) and employment.

6.2.1 Impact on economic growth

Were Australia's early-stage processing capacity to expand and process an additional 170 million kilograms per annum, it is estimated that Australia's Gross Domestic Product (GDP) could be $1.8 billion higher in present value terms between 2023 and 2050, discounted at 7% per annum (Chart 6.1). If only wet processing were undertaken, the present value impact to GDP is estimated at $$1.1 billion, with a smaller impact reflecting the relatively more modest capital investment requirements and ongoing direct employee uplift.

In both scenarios, the initial impacts are driven by the assumed capital investment outlays. For the early-stage processing scenario, capital expenditure impacts to GDP peak at $107.4 million in 2027 and for the wet processing scenario, impacts peak at $55.2 million in that year. Early-stage wool processing capacity is assumed to build while some construction activity is also occurring, however the impacts of processing operations on the economy only begin to dominate after 2029 when the capital expenditure has subsided, and early in the scaling of processing is underway.

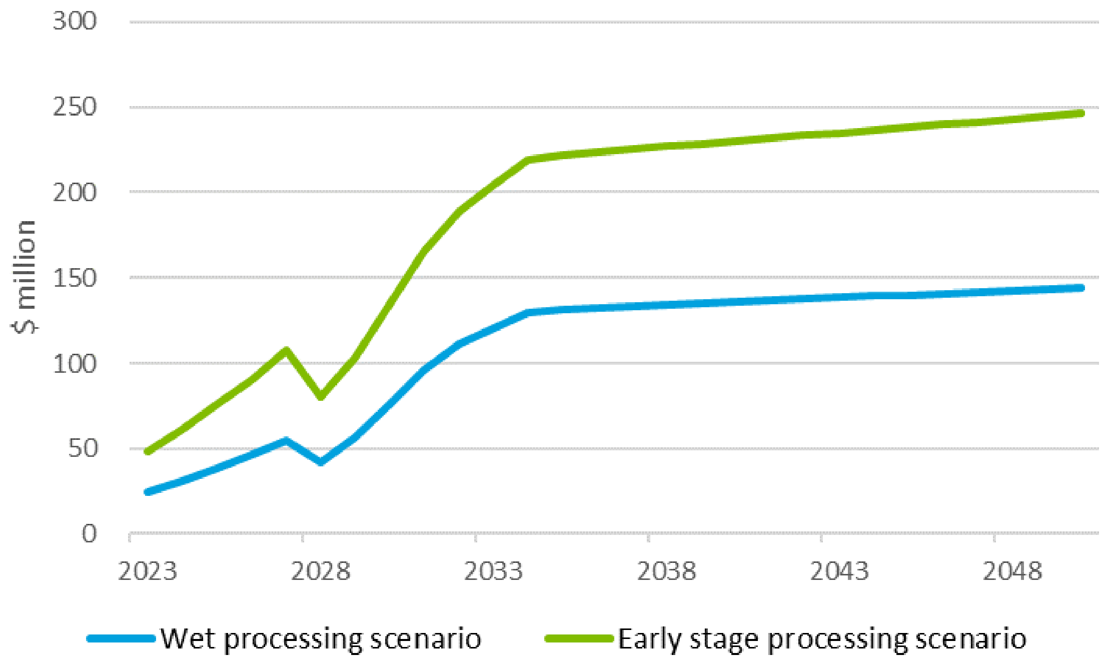
From 2029 onward, impacts to GDP grow in line with the assumed s-curve expansion in Australian early-stage wool processing capacity. Because of this, the projected impacts to GDP rapidly expand and by 2035, GDP is projected to be $221.5 million higher than in the baseline scenario under the early-stage processing scenario. For the wet processing scenario the annual impact to GDP in that year is $130 million.

[24] For integration in the CGE model, the direct employment uplift is converted to an industry output equivalent figure based of ABS Australian Industry data.

[25] These 'direct' employees may be achieved through a range of avenues. This includes net new jobs, where positions are filled through migration or from the pool of unemployed. It also includes people that would otherwise be employed elsewhere. As such net new jobs from the economic impact modelling outputs, are larger than the direct employment numbers provided here that are an input to the modelling.

Modest growth in GDP impacts are observed beyond 2035 because the Australian early-stage processing capacity is assumed to reach its peak additional capacity. Despite processing output not increasing further during this period, annual impacts to GDP expand reach $246.6 million at 2050 in the early-stage processing scenario (and $144.0 million in the wet processing scenario). This result reflects continued growth in other areas of the economy that gain from the expanded processing capacity. This includes Australia's wool growing industry, as well as key parts of the services and manufacturing sectors.

Chart 6.1: Impact on GDP of expanded wool processing in Australia ($ million)



Source: DAE-RGEM (2022).

6.2.2 Impact on employment

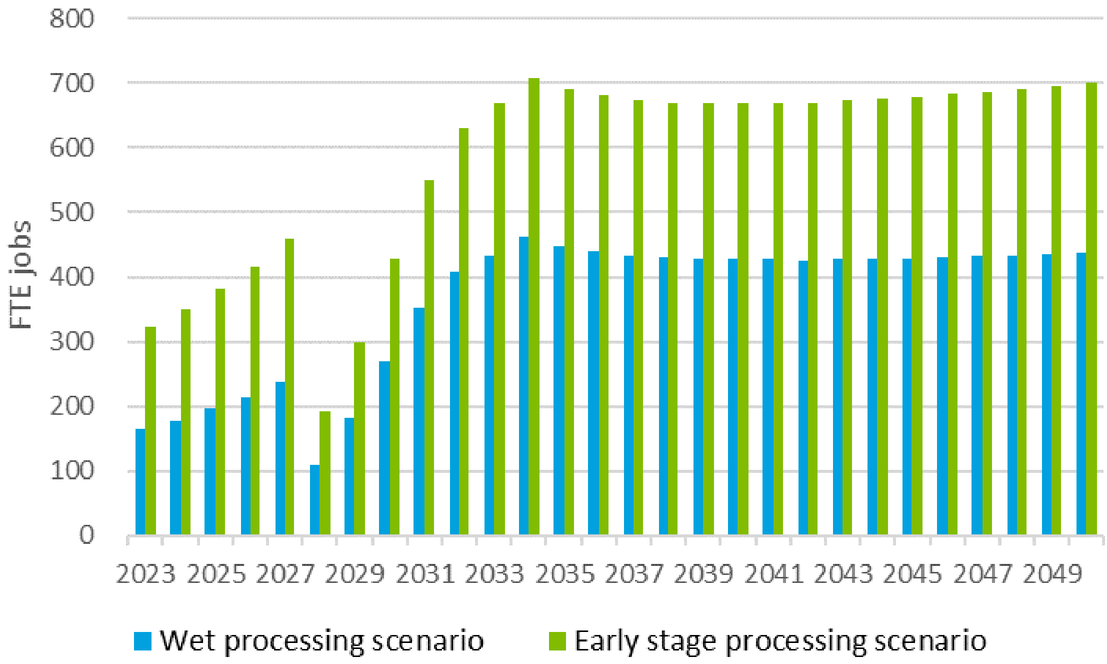
Alongside the increase in Australian economic growth, increased processing of wool in Australia is also modelled to increase employment. Under the early-stage processing scenario, 582 full-time equivalent (FTE) jobs are added to the Australian economy on average between 2023 and 2050. This figure represents new jobs added to the economy with the net change in positions filled by migrating employees or from the pool of unemployed. The net addition of jobs to the whole economy is consequently lower than the direct employment figure for outlined in Table 6.1 which describes employment in the wool processing industry only and includes people who would have otherwise been employed in the Australian economy. For the wet processing scenario, 362 FTE jobs are added on average over the same period (Chart 6.2).

In the early stages, most of the additional employment reflects the capital investment from expanding processing capacity, and during this period employment gains are only a portion of the increase observed during the operations phase. In 2027 for example, there are projected to be 383 additional jobs under the early-stage processing scenario and 239 jobs in the wet processing scenario.

Once processing operations expand additional employment rises rapidly, in line with the assumed expansion in processing. The peak impact to employment is observed in 2035 in line with processing capacity. At this time, the early-stage processing scenario is modelled to have 692 additional FTE jobs, and the wet processing scenario an additional 450 jobs.

After 2035, additional employment in the Australian economy declines modestly initially but recovers to the observed peak in 2035. This reflects continued adjustment in the structure of the economy, including softening investment and capital expenditure that sees more modest gains in construction employment, while most other industries steadily expand.

Chart 6.2: Impact on annual employment stock of expanded processing in Australia (FTE jobs)



Source: DAE-RGEM (2022).

6.3 Supply chain impacts

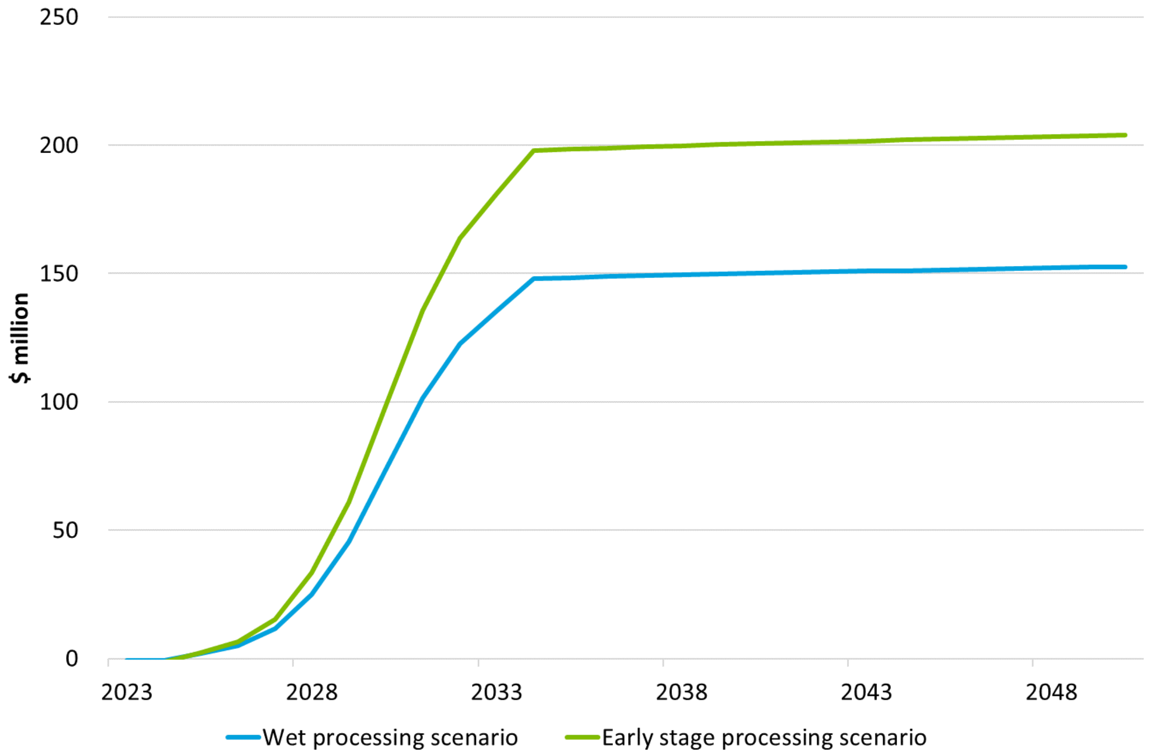
This section discusses how greater wool processing may impact various aspects of the existing wool supply chain. The discussion includes the impact on Australia's wool farmers, in terms of an expansion of industry output, Australia's existing processing industry and competing wool exporters and processors.

6.3.1 Wool growers

An export demand led expansion in Australian early-stage wool processing is expected to have a positive effect on Australia's wool growing industry. If Australia's processing capacity were increased to 170 million kilograms, it is estimated that wool output could be $1.3 billion higher in present value terms for the period as a whole between 2023 and 2050 under the early-stage processing scenario. This increase is driven by rising production volumes with wool producers in Australia responding to strong real prices that are supported by stronger global demand for wool processed in Australia.

The estimated increase in Australian wool output that results from greater processing capacity follows the assumed path of processing activity. No material increases are observed during the construction phase (2023 to 2027), but as processing capacity rapidly lifts out to 2035, wool output closely follows. Once peak capacity is reached in 2035 impacts to wool output plateau leaving it around $200 million per annum above the baseline in the early-stage processing scenario (Chart 6.3).

Chart 6.3: Annual impact on industry output of expanded processing ($ million)



Source: DAE-RGEM (2022).

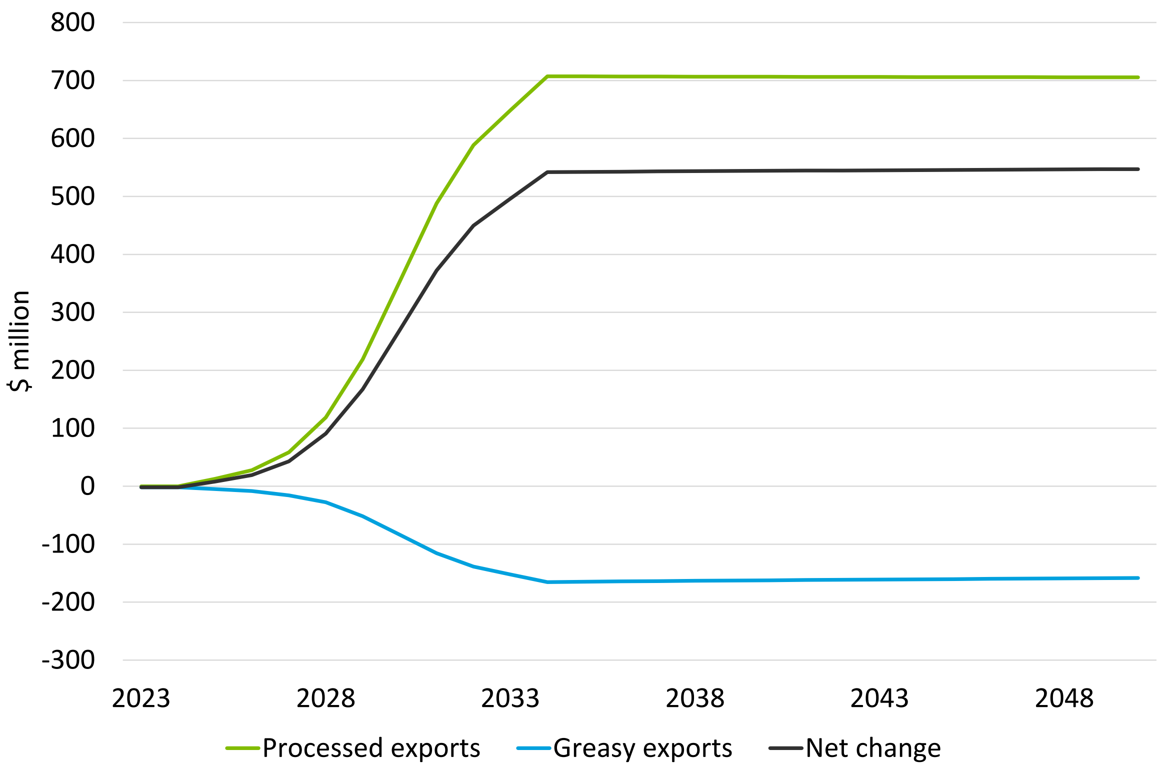
Under the wet processing scenario, the dollar value increase in wool output relative to the baseline is smaller than that observed for the early-stage processing scenario. This in part reflects impacts to prices alongside quantity demand impacts. In the early-stage processing sector stronger growth in price changes results between 2023 and 2050, compounding the projected volume increase in output.

6.3.2 Australian exports

The expansion of processing capacity in Australia is modelled to have a modest positive impact on the value of Australian exports. This is because the modelled expansion processing capacity results in a higher volume of wool production in Australia, and increases in processed exports are somewhat offset by lower greasy wool exports.

Under the early-stage processing scenario, total Australian wool exports are estimated to be $545 million higher on average between each year 2035 and 2050. For the period from 2023, the increase in exports is projected to total $3.6 billion. This consists of a significant gain in processed exports (in the order of $706 million per annum after 2035, but offset by lower greasy wool exports that are projected to be $162 million lower on average between 2023 and 2050.

Chart 6.4: Impact on industry exports, greasy and processed exports, early-stage processing scenario ($ million)



Source: DAE-RGEM (2022).

An increase in wet processing only, is also modelled to lift Australia's total wool exports. In this scenario, processed exports are estimated to be around $390 million per annum higher than the baseline after 2035. This is somewhat offset by lower greasy exports (around $122 million per annum). Combined this results in an estimated increase of around $268 million per annum between 2035 and 2050, with the total increase in exports valued at $1.7 billion between 2023 and 2050.

6.3.3 International participants

As wool forms part of a global value chain expanded activities in Australia are likely to have a material impact in other parts of the global economy. This section discusses the impact to international wool exporting countries that Australia competes with, and other processing countries.

The modelling undertaken here finds little impact to global trade. This in part reflects that the redistribution in wool processing is a relatively modest change in a global textile context, as wool accounts for just 1% of the world's supply of textile fibres. Because of this, large changes to the wool supply chain do not have a material impact on broader macro-economic conditions in overseas countries. With long term economic growth assumed to remain relatively robust over the medium to long term, greater processing in Australia is modelled to cause little disruption to the global economy.

6.3.3.1 Competing wool producers

The expansion of early-stage processing in Australia is estimated to have a modest impact on other wool producing countries. As the expansion in processing is modelled to be led by export demand, demand for wool products from other countries is lower due to economic substitution effects.

Across each of the countries modelled though, the change in wool production is estimated to be modest. This is primarily because very little wool enters Australia (due to strict biosecurity controls) and so greater processing demand in Australia doesn't translate to expanded import demand. For countries other than Australia the percentage deviation in output is projected to be around 0.2% between 2022 and 2050 in the early-stage processing scenario. This compares with a 2.4% deviation for Australia.

Reflecting the limited change in output in countries other than Australia, export volumes are also assumed to materially change in the policy scenarios. Globally the estimated impact to exports in other countries averages 0.1% between 2022 and 2050.

6.3.3.2 Competing wool processors

The expansion of early-stage processing in Australia will also have a modest impact on other processing industries overseas. Between 2023 and 2050, the change in value added in China for example is estimated to be around $370 million lower in present value terms. This compares with $1.3 billion increase for Australia, and represents a net increase globally for wool processing in the order of $1.0 billion. This change is relatively larger than that observed in Australia and reflects both changes to quantity and price effects that result from stronger demand for Australian processed wool.

The reduction in processed wool output has a negligible impact on broader economic activity in China. Across the modelled horizon, the change in Chinese GDP is estimated to be less than 0.1% lower on average. This is because the shift away from early-stage processing frees up capital and labour and allows other parts of the economy to expand.

7 Challenges and opportunities

The scope of this analysis is to consider processing input up to 170 million kilograms per annum. This volume is understood by industry to be the share of wool that is not currently consumed in China in apparel or textile markets, but rather is re-exported in some form to other markets.

This analysis has been based on critical assumptions surrounding the supply chain and investment. This includes the assumption that production processes look like existing operating processes, and that the existing supply chain can adapt at any stage to accommodate proposed changes. In addition, the analysis assumes that investment can be made at a range of plant sizes and there are no challenges faced in terms of the timing of this investment.

This section explores how these assumptions create additional challenges and opportunities that a scaled expansion of processing in Australia may encounter. Issues considered in this section include the potential for future innovation to support competitiveness, as well as potential changes to emissions footprint and supply chain demand.

7.1 Process and value-added innovation

At the firm level, investment in innovation provides the foundation for ground-breaking technologies as well as new and significantly improved processes, products, marketing and organisational practices.[xxxii] In an Australian context, a 2011 paper by the Productivity Commission found a strong and significant relationship between innovation and productivity gains.[xxxiii]

A review of patents shows only 50 Patent Cooperation Treaty (PCT) applications for new wool scouring ideas since 1950. Earlier patents in this period, which focused on anti-felting, new detergents, and treatment for scour water effluent, tended to be granted in a range of territories reflecting the larger number of scours and the dispersed nature of the industry last century. In this century wool scouring commercial and intellectual property interests have consolidated in China and are mostly held by 'private' companies rather than research institutes. The chief focus of Chinese patents has been methods to reduce the environmental and cost burdens associated with water consumption and the discharge of scour water effluent.

It needs to be noted the number of working scours is now quite small and as such there is little value in paying for a patent. Much of the Australian wool scouring IP generated last century, e.g., Siroscour and Sirolan CF, was extended to industry unencumbered by patents and licensing agreements. Improved wool scour productivity over the next 20 years will be realised largely, as it has been in other fibre processing sectors, through increased scale, iteration, and automation of current systems, optimizing factory layout and the use of energy efficient (electric) motors. Returns from waste streams could also increase as the world turns to more circular modes of manufacture.

Firm level innovation can be broadly categorised into two groups, product or process innovations, each of which are discussed below in the context of Australian wool processing.

7.1.1 Process and organisational innovations

Process innovations are changes in production or delivery method and include innovations in techniques, equipment and/or software. Organisational innovations reflect changes in business practices, workplace structure or external relations.

Limited opportunities have been identified for expanded early-stage processing in Australia to support additional process and organisational innovations. The processing cost modelling provided in Appendix B outlines that the main costs incurred during processing are capital costs (namely land and construction expenditure); labour use; waste treatment and energy use. Only energy inputs were identified to have significant potential for process innovation[26] with the existing industry reliant on an energy grid that relies mostly on fossil fuels. This is discussed below in the following sub-section followed by a brief discussion of the other major inputs.

7.1.1.1 Energy use

A global transition is expected to provide opportunities for Australian manufacturing to adopt 'green' technologies.[xxxiv] While most of these are not likely to be commercial intellectual property if adopted, they have the potential to significantly alter international competitiveness.

Renewable energy alternatives are readily available in Australia to offset both grid electricity and natural gas usage in the provision of heat. Solar photovoltaics (PV) for example is a mainstream technology that can be installed on rooftops to offset grid electricity use during the day. Such systems can also be paired with Lithium-ion batteries to support renewable energy use during non-producing hours.

There are a wide range of thermal energy storage (TES) technologies available at different levels of technical readiness. This includes for example sensible heat storage, which most closely aligns with the thermal requirements of scouring.[27] Sensible heat storage can be as simple as thermal tank storage, where water is stored in tanks with heating undertaken using renewable electricity combined with a resistive heating element (as in electric hot water systems), a heat pump (which operates in the same way as a reverse cycle air conditioner) or using thermal energy as in solar hot water systems.

The current capital cost of technologies that are commercially available, technically mature and are suitable for commercial premises such as an early-stage wool processing enterprise are presented in Table 7.1.

Table 7.1: Cost and performance parameters of low emissions technologies suitable for wool processing facilities.

Technology	Capital cost	O&MFIX	Efficiency (%)	Technical life (years)
Rooftop solar PV	$1,333 /kW[xxxv]	0	n.a.	25
Lithium-ion battery system	$1,325 /kWh[28]	9.9		20
Heat pump hot water/steam system	$1,453 /kWth	$30 /kWth/year	350	12
Electric resistive hot water/steam system	$161 /kWth	$3.2 /kWth/year	98	15
Gas hot water/steam system	$74 /kWth	$3.0 /kWth/year	90	20

Source: Provided by CSIRO (2022).
Notes: Kilowatt-thermal (KWth) - A unit of heat-supply capacity used to measure the potential output from a heating plant O&MFIX - Operating and Maintenance fixed costs; The cost for all hot water/steam systems were sourced from the PBL MIDDEN database and converted to 2021 AUD[xxxvi29]; The efficiencies presented in this table refer to the efficiency of converting the input fuel that has a cost associated with it – either electricity or gas – into thermal energy as steam. The heat pump system has an efficiency higher than 100% because it is using pumped hot air to generate steam.

7.1.1.2 Labour use

Labour is the largest cost item for early-stage processors. Innovation that improves labour productivity will therefore likely have a significant impact on long-term competitiveness. Analysis undertaken as part of this project alongside industry consultation has not identified any significant avenues for innovation beyond the steady incremental gains being achieved by the existing industry.

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[26] Data collected through consultation for example identified that current labour requirements were highly efficient, with only modest but steady gains in the last two decades.
[27] Other TES technologies include latent heat storage, thermochemical heat storage and mechanical-thermal coupled systems.
[28] Average of values https://www.solarchoice.net.au/is-home-battery-storage-worth-it/
[29] PBL, the Database (n.d.) <https://www.pbl.nl/en/middenweb/the-database>

With respect to labour, consultation with several stakeholders across differing parts of the supply chain argued that any new early-stage processing capacity is installed with limited labour inputs. This frontier characterisation of the global industry is applicable to the existing Australian processing industry, where modest labour productivity gains have been incrementally achieved in the last two decades indicating that innovation in labour use may continue to yield modest process improvements in the short to medium term.

In the three years to 2000-01, the wool scouring industry employed 11.5 Full Time Equivalent persons per million dollars in value added. In the three years to 2020-21, 10.1 FTEs per million dollars was registered, indicating an improvement of around 12% over the 20 years. This equates to 0.6% a year, and is around a third of that achieved for the Australian economy on average (1.6% per annum since 2000-01).[xxxvii]

7.1.1.3 Waste management

Innovation in waste management for wet processors is likely to be a central issue for the industry's long term international competitiveness. This is because waste management costs now account for a substantial portion of the total operating costs, with prices rising faster than most other inputs since the early 2000s.

There has been considerable innovation in on-site wastewater treatment in several industries in recent decades (e.g. food processing, dairy, meat processing). The quality of effluent has improved in many industries and water recycling is being increasingly adopted to minimize water use. This however has not been applicable to wool scouring where effluent in urban areas is still generally disposed of directly to municipal sewers. For example, the Australian effluent management guidelines for aqueous wool scouring and carbonizing have not been updated since 1999, despite the decreasing costs of many wastewater treatment technologies such as membranes. It is assessed that further gains in on site treatment are likely to be incremental over the short to medium term.

The options for effluent treatment considered for this analysis were dictated by the assumption that the treatment facility is in an urban location. This placed necessary constraints on the supply of land that would be available for a processor.

However, alternative models for wastewater treatment exist if considering early-stage processing facilities in a rural location.

An example of this is Lanas Trinidad, a processor of scoured wool and wool tops in Uruguay with an annual production of 10 million kilograms. There, 140 hectares of land is dedicated to the treatment of effluent water. Processes include the use of rainwater during scouring, aerobic and anaerobic effluent treatment, ponding systems, re-use of treated effluent for irrigation of a woodlot to sequester CO_2 and the capturing of methane gas from these processes to generate electricity.

Adopting circular economy processing principles is an option for an expanded Australian processing industry. Whilst the full impact of such operational changes is not yet quantified, they could potentially offer a reduced environmental footprint in addition to cost savings.

7.1.2 Product and marketing innovation

Product and marketing innovations include changes to goods or services that are new or significantly improved (such as improvements in technical specifications, components and materials, software in the product, user friendliness or other functional characteristics or significant changes in product design or packaging, product placement, product promotion or pricing.

A range of product and market innovations are currently being driven by strengthening consumer demand. This includes marketing of animal welfare, environmental and sustainability attributes. These attributes can deliver tangible improvements to key performance indicators for the Australian wool industry. For example, analysis by Mecardo found Responsible Wool Standard premiums achieved in South Africa in November 2021 were around US$2.50 per kilogram.[xxxviii] Such premiums support a range of metrics outlined in the Sheep Sustainability Framework, including value of production (8.2.1b) and exports (9.1.1b), as well as rates of return (8.1.1) and productivity growth (8.3.1a).[30,xxxix]

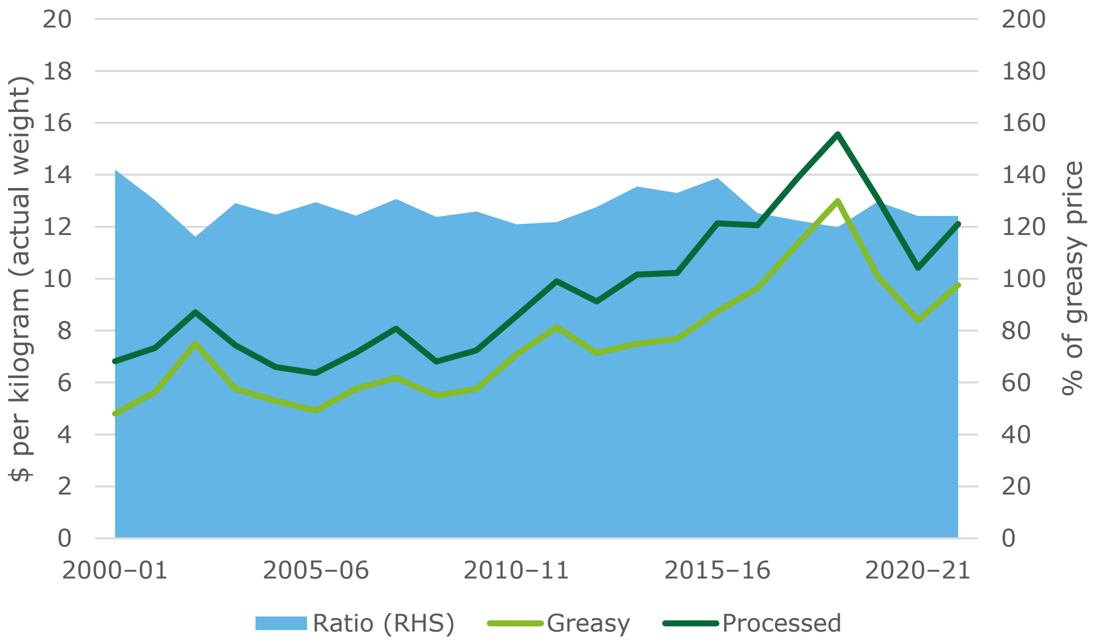
The role of early-stage processing in achieving sustainability or traceability improvements is as a facilitator, with driving demand ultimately determined further down the supply chain closer to consumers. Consultation with industry highlighted that promotion of sustainability or traceability attributes are largely a commercial decision and not influenced by the geographic location of processing activities.

While focussed on internal ethical operations, rather than the attributes of the raw wool, the commercial nature of such decisions is highlighted by the experience of Michell Wool in China. In setting up its overseas processing organisation, Michell Wool introduced workplace health and safety and environmental requirements in line with Australian standards. These practices exceeded those that were in place in China at the time but are understood to have supported the organisations long term viability in a dynamic and challenging commercial environment.[xl]

Outside of sustainability attributes, there are assessed to be only modest opportunities to add significant value to wool during early-stage processing via product or marketing innovation (Box 2 below outlines potential value-added opportunities for co-products namely recovered solids). This includes niche opportunities in small batch processing for example such as the one million kilograms of yarn spun by Bendigo Woollen Mills for the local hand knitting market.[xli]

Larger scale opportunities to add value to the raw wool being processed are limited by the structure of business operations, particularly around commercial tariff setting. Commission scours set these according to production systems geared towards maximising throughput and cost minimisation. The opportunity for early-stage processing to demonstrate its value adding potential has historically been a challenging exercise. Export unit values for processed wool from Australia have historically been a relatively constant share of greasy exports (around 120% since 2000-01; Chart 7.1).

Chart 7.1: Export unit values for greasy and processed wool in greasy equivalent terms



Source: ABARES (2022).

[30] Metrics of the Sheep Sustainability Framework.

Box 2: Solid waste recovery in wet processing

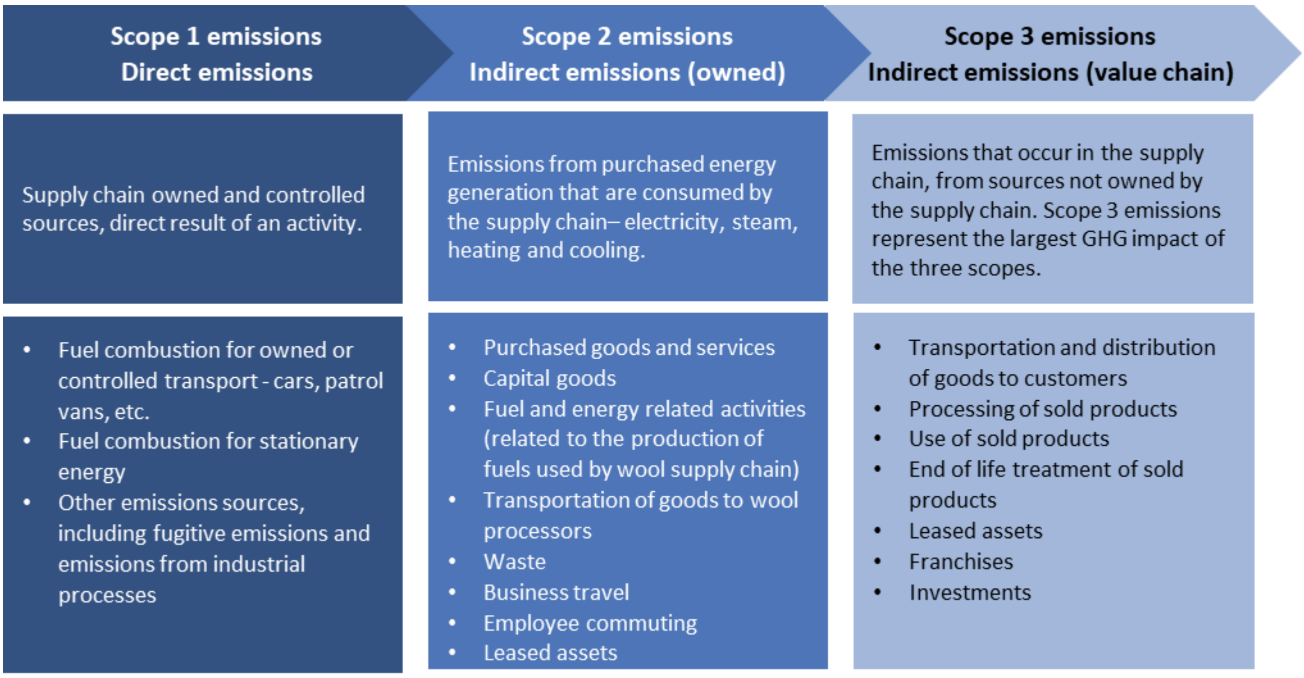
During wet processing, solid extraneous matter is separated from greasy wool via scouring and or carbonising. This includes wool grease which provides a material return for processors, but also solid waste products. Increasingly, Australia and the global economy are adopting circular economy principles and exploring opportunities to recover or reuse waste materials in high value applications. Advice provided by industry indicates that there may be greater opportunities in the future to employ solid waste from wet processing in circular pathways.

Composting has been investigated in Australia since at least the 1990s. A 2016 UK study for example found that scouring waste was able to produce a safe and effective composting material. While there may be technical barriers to the reuse of scouring waste, it is likely that main barriers include transport and application costs. Such issues are regularly identified in surveys of potential users for organic waste from households or commercial businesses. This includes for example an NSW based survey of farmers to identify barriers they faced in using compost derived from organic waste.[xlii]

7.2 Emissions from processing

The emissions footprint of the wool supply chain, and the textile industry is of growing importance to consumers and policy makers. Greater early-stage processing of wool in Australia has the potential to transform the supply chain's existing emissions footprint.[31] This includes the on-shoring of scope 1 and scope 2 emissions for Australia, and also changes to emissions intensity.

Figure 7.1: Scope 1, 2 and 3 emissions



7.2.2 Scope 1 and 2 emissions

Early-stage processing is estimated to have a relatively significant emissions footprint across both the worsted and woollen systems. In wet processing, both electricity and gas are assumed to be employed. For dry processing of carding and or combing, only electricity is assumed to be used. Estimated emissions intensities for the stylised Australian worsted and woollen early-stage wool

[31] Recent work by Weiderman et al (2020) demonstrates that the quantitative understanding of emissions footprints of the textile industries' end markets are in the early stages of understanding and relatively sensitive to assumptions and approach.

processing enterprises (as described in Section 4) are based on modelled energy use and estimated energy intensities reported by the Australian government.[32,xliii]

Were Australia to undertake more early-stage processing of wool, there is potential for scope 1 and 2 emissions for the processing industry to rise. The increase ultimately depends on the specific operations,[33] as well as the scale of expanded processing. Were stylised processors (as described in Section 4 and Appendix C) to drive the increase in processing, the potential emissions increase is illustrated in Table 7.2.

Table 7.2: Stylised industry wide increases in emissions from greater wool processing, various output increases, tonnes of CO2e

Greasy wool throughput (million kgs)	Worsted system		Woollen system	
	Wet processing	Total	Wet processing	Total
10	5,059	6,196	7,646	8,609
20	10,118	12,393	15,292	17,217
25	12,647	15,491	19,115	21,522
50	25,294	30,982	38,231	43,043
100	50,589	61,964	76,462	86,087
150	75,883	92,945	114,693	129,130
170	86,000	105,338	129,985	146,348

Source: Deloitte Access Economics analysis of TechNZ and DISR data (2022).

For wet processing in the worsted system, an increase in throughput of 10 million kilograms (greasy), the processing industry may produce around 5,059 tonnes of CO2-e (scope 1 or 2) for, and 6,196 tonnes were the wool also processed into tops. These both represent less than 0.01% of 2021 Australian industry emissions (31.9 million tonnes).[xliii]

As the scale of processing increases (all else constant), it is anticipated that emissions from processing could be expected to increase. At 170 million kilograms, the worsted system could for example add an additional 105,338 tonnes of CO2-e. At this level, changes to Australia's industry emissions could be considered relatively modest at 0.33% of 2021 Australian industry emissions.[34] However with growing public concern and increased policy momentum supporting reductions across the Australian economy, any increase in emissions (even modest ones) may prove challenging to accommodate over the long term. Given this environment, there is significant opportunity for the Australian wool supply chain to explore a green led expansion of processing capacity. In doing so, the supply chain might support multiple stated objectives of the Australian government including risk mitigation through diversified supply chains, but also a globally competitive and decarbonised industrial sector.

[32] 0.875 kg of CO2e per kWh of electricity (averaged across the Australian grid) and 0.52 kg of CO2e per MJ from burning natural gas.
[33] A renewable powered facility for example may have a significantly lower emissions footprint than that outlined here
[34] These relative comparisons are indicative only, as they do not account for the time required for such processing capacity to establish. Nor do they account for the future potential transition of the Australian energy market over such time (with renewables anticipated to become increasingly prevalent). The broader Australian economy would also be expected to adjust to the establishment of greater processing capacity (as described in Section 5.4). This, combined with the increased capacity would be expected to affect Australia's total emissions including, for example, any changes to enteric fermentation emissions from an expanded sheep flock or crowding out of the relatively emissions intensive heavy manufacturing industry.

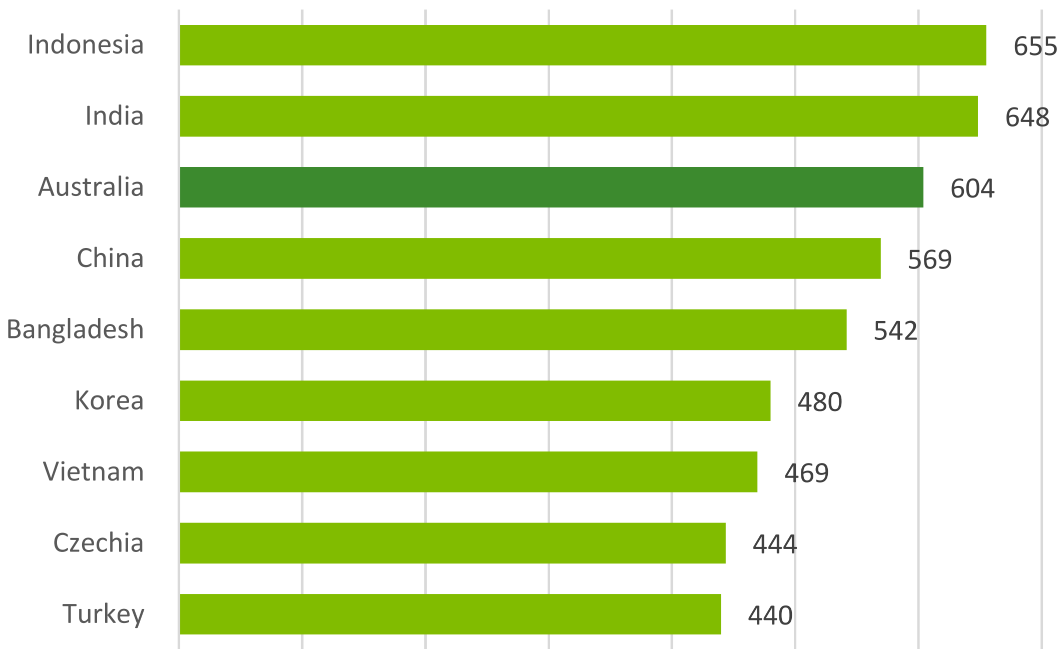
7.2.3 Supply chain emissions

Diversification of early-stage processing is also likely to affect the emissions footprint of the supply chain. Part of this is due to changes to transport emissions, but also from the emissions intensity of firms and the energy networks from which they are powered. To assess the potential change in emissions intensity, emissions are totalled along the supply chains described in Section 4 from farm to processor customers (e.g. spinner) in selected countries.

Across the priority locations, diversification of wool processing has mixed effects on the emissions footprint of the supply chain. Under the status quo where wool is processed to tops in China and exported to a priority country, 23.79 kg of CO2-e/kg of wool is produced. This compares with 23.82 kg of CO2-e under a diversified supply chain where wool is processed to tops in Australia then exported to the same customer country. When comparing supply chains where scouring is undertaken in either Australia or China before exporting, emissions intensities are estimated to be roughly equivalent at 23.8 kg of CO2e/kg.

The mixed effect of supply chain diversification on emissions between farm and customer country is due to international differences in electrical grid carbon intensities. While transport efficiency gains, in general sees fewer emissions from road and sea-freight transport (0.02 kg CO2e/kg of wool). However, processing in Australia is assumed to draw from an electrical grid that is more carbon intensive than most other countries. This is illustrated in Table 7.2, with processing in Australia drawing from an electrical grid that produces 0.03 kg of CO2-e/kg of wool more than the status quo.

Chart 7.2: Emissions intensity of electricity, Australia and selected countries, grams of CO2e/kWh, 5-year average to 2020



Source: Our World in Data (2022).[xliv]

7.3 Interaction with Australia's existing industry

The introduction of additional local processing capacity is likely to disrupt the status quo for early-stage processors in Australia. However, the specific impact on existing firms depends on a range of factors including the degree to which capacity expands, what segments of the market are occupied and how the expansion takes place.[35]

As outlined in Section 2.2, Australia's early-stage processing industry is comprised of a small number of moderately sized firms. These firms supply scouring and carbonising for both worsted and woollen products, and work on a commission basis. Advice provided by industry indicated that Australia's existing processors were operating at around half capacity.

During 5 years to 2021 (including the COVID-19 affected 2020-21), exports of scoured and carbonised wool averaged 23.6 million kilograms (greasy) per annum, implying that peak annual industry capacity sits somewhere close to 50 million kilograms. The capacity underutilisation that is advised to currently exist equates to around 15% of 170 million kg, indicating that a significant expansion in capacity would be required to meet the target level of output.

At least part of the targeted expansion in capacity could be achieved by existing industry. At least one of Australia's processors has the site space to install additional scouring lines, avoiding the need to outlay capital for land purchases or building construction. Adding an additional scour line that has a capacity of 12 million kg per annum (as modelled in Section 4) would account for a modest share of the targeted increase at 7%. Were each existing processor to double capacity, this would represent to a capacity increase equivalent to 21.2% of the targeted 170 million kilograms.

Given the limited potential for existing industry to account for the targeted increase in supply, it is likely that to achieve the 170 million aspirational target new (or returning) entrants would be required into Australia's processing industry.

As previously outlined, industry advised that the minimum new size for a new entrant is assessed by industry to be 12.0 million kilograms of greasy wool per annum for a worsted system processor. Industry also advised that at the other end of the scale, the largest scouring operation in the world has a capacity of at most 25-30 million kilograms per annum, achieved by operating multiple scour lines.

These figures give a range of possible firm numbers required to meet the 170-million-greasy kilogram target. An industry comprised of only small, minimum viable entities that process 12 million greasy kilograms per annum on average equates to 14 individual firms. While an industry with globally leading firm level scale may only have around 6 new entrants.

All else equal, an increase in installed capacity from new entrants would be expected to increase competition among existing industry. This would place pressure on commission scouring tariffs, potentially affect viability of existing industry and potential new entrants alike. This relationship is highlighted by the Productivity Commission (2015) which found firm survivability in an Australian is positively correlated with turnover.[xlv] Broader demand (discussed in the following section) is therefore a critical aspect that shapes how existing industry structures could be affected by expanded capacity.

7.4 Demand for early-stage processed wool from Australia

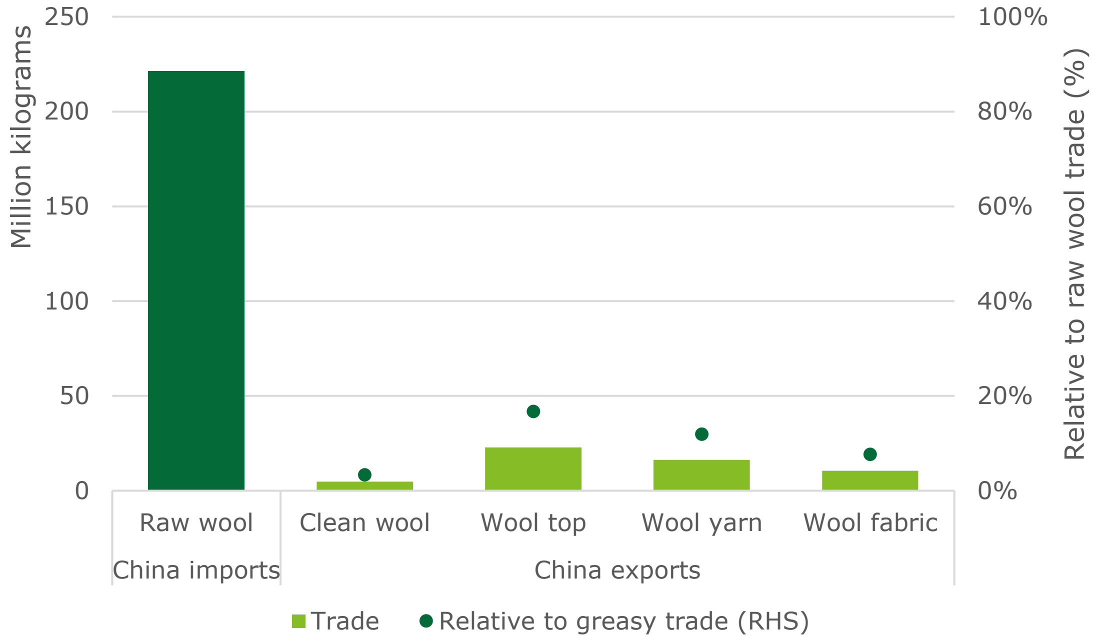
The existing wool supply chain is characterised by vertical integration across processing stages. Wet and dry early-stage processing for example is typically co-located. These early stages are also often in close proximity to latter stage processors (e.g. spinners) and other textile industry participants.

This is demonstrated by comparing selected trade of wool products. In 2020 for example, China imported 221 million kilograms of greasy wool, but exported just 5 million kilograms of clean wool.

[35] Additional installed processing capacity, all else constant, would be expected to increase competition among suppliers. For this reason, demand conditions are viewed as particularly important as greater supply This would likely result in downward pressure on prices with the potential to affect profitability and viability among industry incumbents.

A similarly small volume of wool top (22.8 million kg) was exported by China in 2020, as well as wool yarn (16.3 million kg) and wool fabric (10.5 million kg; Chart 7.3).

Chart 7.3: Trade in selected wool products, 2020



Source: IWTO (2022).
Note: Relative to raw wool trade is in greasy equivalent terms.

The relative portion of trade in processed wool products has been relatively consistent over time. Since 2015, China has exported around 16% of its greasy imports as wool tops and a further 13% as yarn. In contrast, China's exports of clean wool have become increasingly small relative to imports. In 2015 for example, China exported clean wool accounted for around 7% of its greasy imports, nearly double that in 2020.[36]

Combined, these figures indicate that trade in wool products through China is increasingly being processed into more finished apparel and functional textile products once imported. The limited volume of trade in processed wool reflects broader trends of supply chain consolidation where major exporters have shifted away from sourcing from a multitude of small firms to supply chains characterised by a reduced number of larger strategic suppliers that can source materials, coordinate logistics and facilitate shorter delivery cycles (Forstater, 2010; Staritz, 2012).[xlvi]

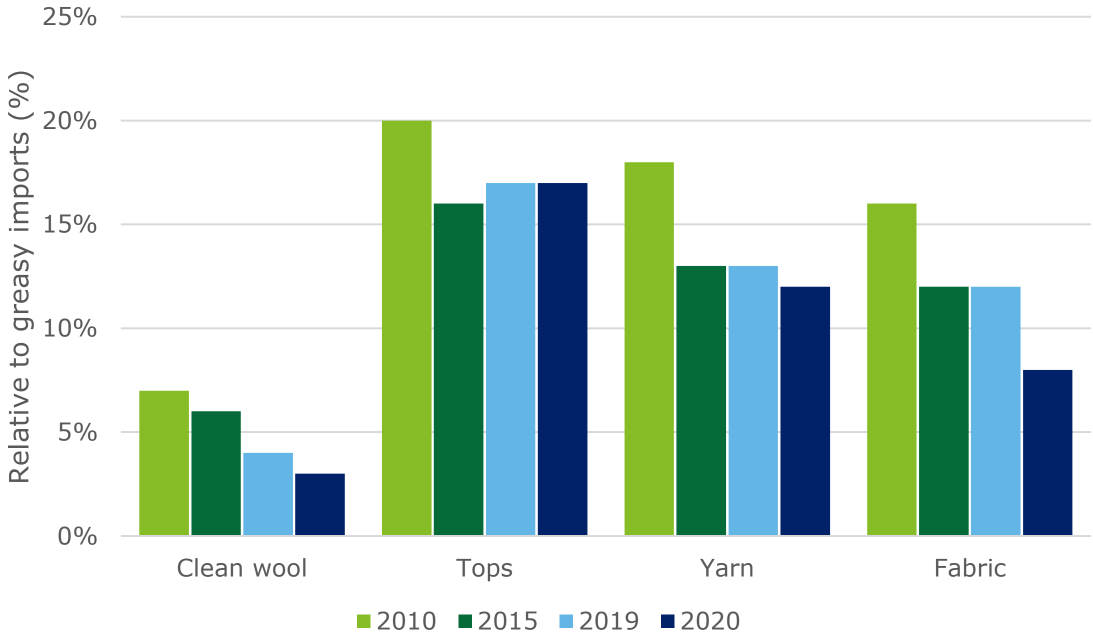
Undertaking greater early-stage processing in Australia would represent a significant deviation from long term trends in the configuration of the wool supply chain. This is particularly true for clean wool where trade is a fraction of that in wool tops. Consultation with industry identified a range of barriers in reconfiguring the supply chain to involve splitting wet (scouring and carbonising) and dry (carding and or combing) activities.

One of the main barriers identified during consultation with supply chain participants in Australia and overseas was that there was a perceived risk of introducing yield losses by splitting early-stage processing into independent wet and dry activities. While no specific quoted yield losses were provided, most participants argued that losses of even 1% could not be tolerated and aversion to such losses were particularly strong for lower micron wools where unit prices are higher. Consultation with Australia's processing industry argued that the above barrier was largely a perceived issue rather than a technical barrier. Existing trade conducted by Australia's

[36] Similar trends are observed for wool fabric, although the bookended dates of 2010 and 2020 are considered relatively anomalous years

processors avoided or adequately managed yield losses by ensuring processed wool was packed, handled and unloaded under specific conditions.

Chart 7.4: China exports in selected wool products relative to greasy wool imports, selected years



Source: IWTO (2022).

Note: Relative to greasy wool trade in greasy equivalent terms.

Other barriers to adoption of split wet and dry processing include demand from carding and combing operations for vertical control of its inputs. By decoupling wet and dry processing activities, dry combers and top makers relinquish a degree of control over inputs to their own production process. During consultation supply chain participants argued that processing control was particularly important for timing considerations and ability to flexibility adapt.[37] One dry comber reported that were it allowed to undertake wet processing activities in its country of operation, it would improve its ability to control quality of inputs to its combing activities and adapt to changing needs further along the processing supply chain as required.

A combination of strategies could be employed to address resistance to supply chain restructure within the broader wool and textile industry. Firstly, a focus of future research could help define objective measurements of the physical impacts of splitting wet and dry stages. Should they be significant, processing innovations can be developed to reduce them. With this increased transparency, commercial relationships will likely also form a key pillar in maintaining trust across the supply chain, so that suppliers are seen as able to meet the needs of downstream customers.

7.5 Barriers to entry

7.5.1 Minimum viable size

The analysis of this report has been informed by consultation with the processing industry in Australia and overseas. This includes the modelling which selected a 3.0m scour as the central processing configuration, based on expert assessment that it was the minimum viable investment

[37] Timing is a central concern for textile supply chains that are increasingly orientated around just-in-time principles with low retail inventories and the need to respond to swiftly changing fashion trends. While flexibility is important in part because wool is a natural fibre and its innate variability requires careful management throughout its journey to consumer markets.

for a new entrant into the market, in Australia or overseas. Industry advised that anything smaller (e.g. a 2.0m scour) would likely be considered a boutique processor.[38]

The installation of a scouring or carbonising facility of the size modelled in this report would represent an increase of current throughput of up to 50%. A minimum viable enterprise new entrant would be a sizable operation that would carry significant risk. This, combined with the technical nature of manufacturing activities it is assessed that any entrant into Australia is likely to be a relocating international enterprise rather than a truly new entrant to the industry. As such the minimum viable size acts in effect as a barrier to entry by restricting the possible pool of investors to existing entities.

7.5.2 Required capital investment

The capital costs required to invest in and develop an early-stage wool processing business are estimated to be large. For a worsted system, the investment for a greenfield site is estimated to total A$121.0 million. For a woollen system that incorporated carbonising, capital costs are estimated to be higher at A$136.8 million.

Expanding processing capacity by 170 million kg of wool could therefore require up to A$1.12 billion in capital investment. This assumes most new entrants are greenfield sites and situated in similar locations to the existing industry. This outlay is significant and equates to around double the reported cost of the new Sydney football stadium (A$830 million).

Most of the capital outlay is estimated to consist of building and land purchases which total $72.2 million for an integrated worsted system processor. Machinery costs are also significant, totalling $45.1 million for the same operation. These costs are significant in the context of industry cashflow, representing a significant barrier for both new entrants as well as existing industry players for upgrading capital.

Table A.1: Summary of capital costs, by processing stage, US$ million

System	Stage	Building and land	Effluent treatment	Machinery	Total
Worsted	Scouring	$43.4	$3.6	$9.4	**$56.4**
	Top making	$28.8	$0.0	$35.7	**$64.5**
	Total	**$72.2**	**$3.6**	**$45.1**	**$121.0**
Woollen	Scouring	$43.4	$3.6	$9.4	**$56.4**
	Carbonising	$18.0	$0.0	$17.1	**$35.2**
	Carding	$20.2	$0.0	$25.0	**$45.2**
	Total	**$81.6**	**$3.6**	**$51.6**	**$136.8**

Source: Rawlinsons (2014), Deloitte Access Economics (2022) and NSC Schlumberger (2022).

Payback periods (the time taken to recoup an outlay of capital) are one of the most common methods firms can use to evaluate investment opportunities.[39] Reserve Bank of Australia led consultations with Australian businesses in 2017 which revealed that the most common payback period is three years, with similar findings also reported in the United States and the United Kingdom.[40,xlvii,xlviii]

Estimating payback periods for early-stage wool processing is uncertain due to the natural variability in tariff rates and wool grease prices. Despite this uncertainty, payback periods are estimated to be far longer than 3 years. For example, an investment into worsted system wet processing is estimated to have a payback period of at least 10 years assuming recovered grease

[38] Such an entity was advised as having a niche market only and unlikely to facilitate material diversification
[39] Payback periods do not account for the time value of money and ignore cash flows beyond cut-off dates
[40] Many firms reported to the RBA that payback periods were much shorter than 3 years

contributes around $0.53 per kilogram processed and quoted tariff rates start at $0.50 per kilogram.

The deterring effect of large capital investment requirements was confirmed during consultation with industry. Participants pointed out that internationally, commercial or institutional investors were largely absent from the market as the relatively low rates of return and longer pay back periods were only tolerable for family businesses or sole investors. Similarly, industry advised that global machinery purchases has largely consisted of trade in second-hand machinery, while existing industry players in Australia are understood to be operating with capital equipment purchased more than two decades ago.

7.6 Time to scale

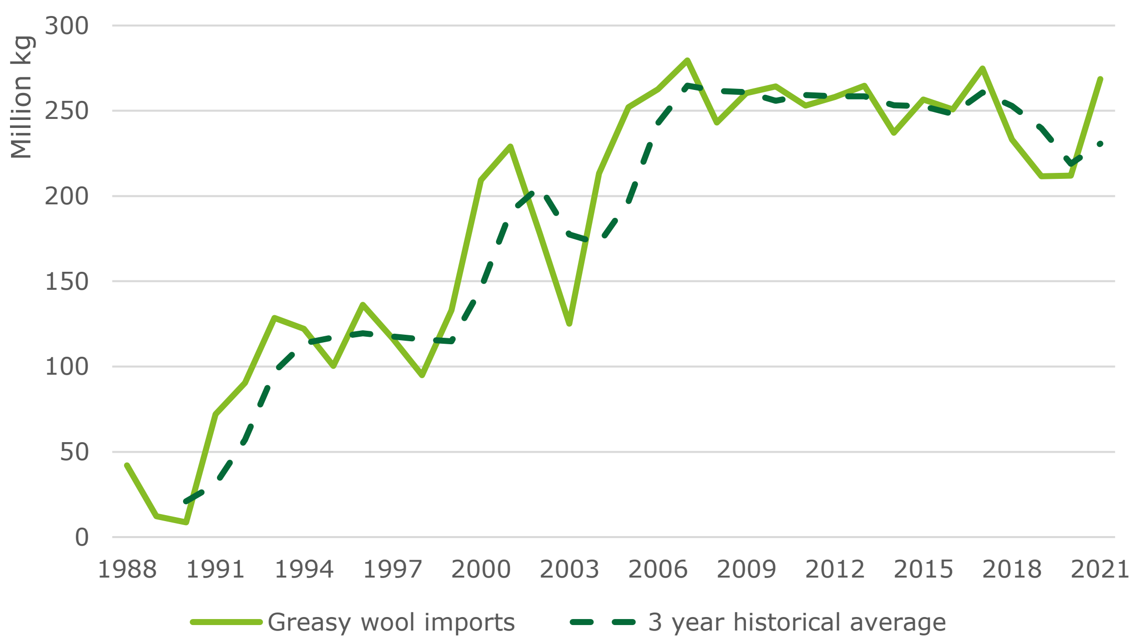
The time required for industry to scale to 170 million kilograms is uncertain, depending on the number of firms, whether they are new entrants or existing players and the speed at which they can reach optimal capacity.

Advice provided by industry during consultation indicated that establishing a greenfield site is estimated to take more than 5 years to reach capacity after breaking ground. This includes two to three years required for land acquisition and construction, with the remaining time steadily expanding throughput to match the capacity of the installed machinery. It was also advised by industry that losses are common during this period with testing and refining of wool processing, a costly exercise due to the high unit value of the raw input material (see section 2.1.2).

It is likely that expansion in Australia's capacity up to 170 million kilograms would require new entrants into the Australian market. As outlined in section 7.3, to achieve this level of throughput up to 14 new firms could be required. Were this to occur, entry is unlikely to occur simultaneously. Rather the growth in capacity is expected to follow an incremental path with leading firms entering first, after which following firms subsequently establish capacity in Australia.

This is understood to be the expansion path of China's wool processing industry during the 1990s and 2000s. Chart 7.5 describes Chinese imports of greasy wool from Australia and shows an increase of around 170 million kilograms between 1990 and 2000. This increase occurred amidst a broader staggered expansion out to 2007.

Chart 7.5: Chinese imports of Australian greasy wool, 1988 to 2021



Source: UN Comtrade (2022).

7.7 Potential for economies of scale

Economies of scale describe the gains to firm or industry productivity from increasing in size. Firm level economies of scale are discussed in B.3. Industry level scales of economy can be grouped under three broad headings:

- Purchasing – lower unit costs provided to industry (e.g. utilities use for base demand load)
- Organisation – ability to coordinate activities (e.g. logistics gains from centralised hub activities)[41]
- Technological – knowledge and innovation spillovers from research and development within a firm or firms.

The cost structure of processing activities (as described in Section 3) are heavily orientated to labour and utilities. Any increase in industry scale is unlikely to have a material effect on the unit costs of labour, energy or water, and therefore deliver purchasing economies of scale.[42] One possible avenue for purchase economies of scale might be in solid waste disposal. Were any processors to be in close proximity, it is possible that waste management services industry may benefit from more efficient collection services. Given the central role of waste costs for wet and early-stage processing, and steadily rising costs, such gains could be material in the future.

Knowledge and innovation spillovers from any expansion in processing activity in Australia is also uncertain. This is in part because Australia's industry currently contains a select few moderately sized players that conduct any research and development in house, and the outcomes are commercial intellectual property.

Historically the industry was supported by R&D efforts by organisations such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), however most of this support was phased out in the 1990s and 2000s in line with the exit of the processing industry (see 7.1 for more detail).

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[41] This project does not assess the specific location of any future potential expansion in Australia's processing capacity, and so any potential gains to the industry from agglomeration are not discussed in this report.

[42] One issue raised by industry during consultation was the increasingly specialised labour needs of processing in Australia, particularly latter stages. Industry scale may provide greater career pathway opportunities and facilitate improved access to labour, without necessarily reducing costs. However, it is also acknowledged that many other industries in Australia are also facing similar labour access constraints

8 The case for further analysis

This chapter summarises the findings of the report and provides an overview of options to support diversification of Australia's wool supply chain through expanding early-stage processing.

While high labour costs remain a significant challenge for Australian early-stage wool processing, the modelling presented in this report demonstrates that Australia has the potential to be cost competitive in the global market. Productivity gains may strengthen future competitiveness for Australian industry, although a range of other challenges have also been identified for a targeted expansion in Australian wool processing. This includes:

- **High capital costs** - with the targeted 170 million kilograms estimated to require around $800 million of worsted scouring investment
- **A limited pool of potential investors** – with wool processing combining complex mechanical processes with tacit knowledge of fibre blending
- **Little appetite for supply chain restructure –** where the supply chain continues to prefer the status quo to avoid yield losses and additional costs.
- **R&D environment –** limited innovation has occurred within the Australian industry in recent decades, limiting long term competitiveness and potential risk resilience.

The above challenges are assessed to limit the potential for a commercially driven expansion in Australian processing over the medium to long term. Given the emerging risks faced by the wool supply chain, and the potential for processing to actively manage those risks, there is a reasonable case for government intervention.

While this report identifies that processing in Australia can be commercially competitive and there are opportunities for diversification of the supply chain, there are a range of additional aspects to consider. This includes for example the specific commercial arrangements; where in Australia processing might be located; as well as the commercial pathways and partners for long term success. These items are typically considered in detail within business cases provided to government.

Such business cases provide an evidence base for government intervention and typically consider an array of options for addressing the defined problem, including for example the likelihood of risks, and the economic and social benefits of the options. Given the complexity of the wool supply chain it is proposed that two business cases are developed:

The first business case should consider pathways to strengthen demand in overseas locations.

Much of the underpinning competitiveness on price stems from maintaining high throughput and lowering fixed costs. To achieve adequately high throughput, demand for wool that has been processed in Australia must be strong. Were Australian wet processing to expand in Australia, export markets must be created or developed, including in priority locations.

This business case would require the collection of detailed information in those markets and cover industry participants, market segmentation, growth plans and barriers to greater use of clean wool. The business case would also need to consider ways to overcome perceived barriers to splitting wet and dry processing such as yield losses.

A second business case should consider investment in processing capacity in Australia.

Were demand for early stage processed wool from Australia to rise, significant barriers may limit the ability for capacity to expand. There is an array of ways which government policy can support expanded capacity in Australia. If developed, a business case provides a sufficient avenue for potential options to be developed and analysed. Options that proceed should be assessed as strategically, legally and practically viable and would include a robust analysis of economic and social impacts. In doing so, the Business Case should also consider the opportunity to support the broader decarbonisation and sustainable objectives of the wool supply chain through 'green' or 'circular' investment opportunities.

A successful Business Case can result in a number of outcomes, ranging from a 'no go' to the approval for new infrastructure spend is required. Depending on the decision reached, a successful business case will enable the supply chain to subsequently pursue diversification ensuring that:

- any investment has value, importance and relevance
- the implementation will be properly managed
- there is appropriate capability to deliver the benefits
- resources are appropriately allocated, and
- inter-dependencies are undertaken in appropriate order.

Undertake a strategic review of investment in wool industry Research, Development and Extension (RD&E).

Productivity growth was once a central feature of Australia's wool processing industry underpinned by research undertaken across an array of public and private institutions. With productivity growth slowing considerably alongside the decline in processing capacity, challenges to global competitiveness have emerged. To support future international competitiveness there is a need to strategically consider research and development opportunities related to processing of wool in Australia. This report has identified several areas where research would be beneficial, while others may be further identified by industry. These areas include:

- technical and logistical barriers to splitting wet and dry processing stages
- potential value-adding opportunities to processing and waste outputs
- innovation in processing inputs including on-site wastewater treatment, labour and energy.

Funding could be secured from a range of sources including through traditional agricultural industry pathways such as levy funds. This innovation could complement existing government schemes such as the Modern Manufacturing Initiative, which could expand to include wool fibres in its scope.

Appendix A: Shortlisted locations

A.1. Bangladesh

Bangladesh is a global leader for the manufacturing of Ready-Made Garments (RMG) with wool a niche market. While small, the market is assessed as having significant potential due largely to expected strong growth in textile manufacturing. This, combined with limited risk exposure (across tariffs, NTMs or animal disease controls) make the market an attractive option for diversifying Australia's wool supply chain processed wool only.

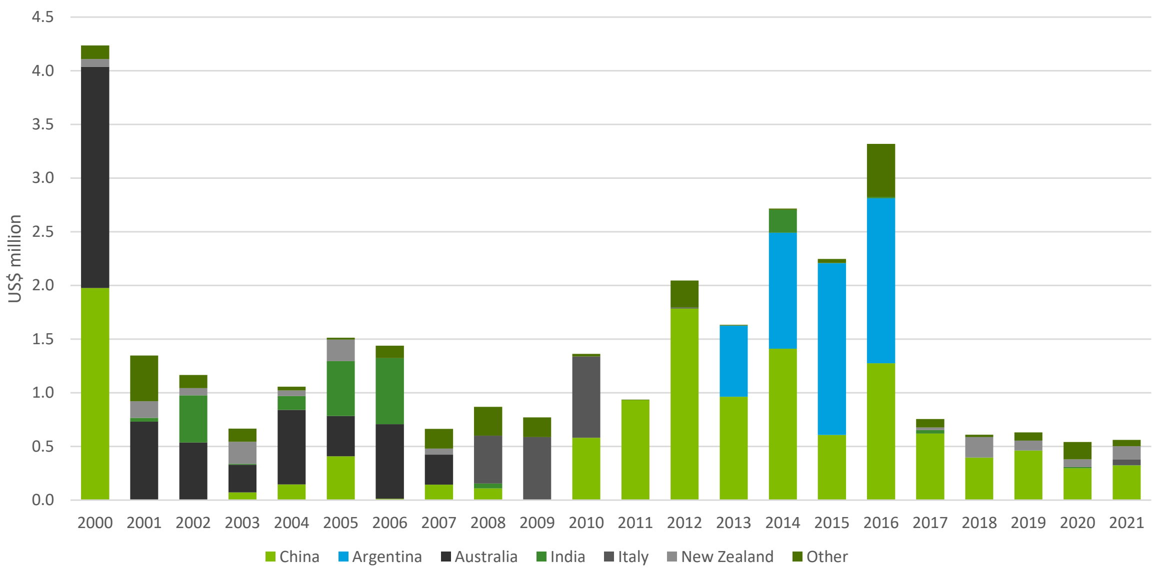
Bangladesh was excluded from consideration for diversification of greasy wool exports. This was based on input from the Expert Reference Group and industry members that concluded the regulatory and business environments were prohibitive to the development of a wet processing industry. This was particularly due to potential for heavy regulation of wastewater and effluent treatment.

Challenges in expanding exports to this market include soft scores across regulatory and other commercial barriers, as well as limited existing demand for scoured wool and no history of greasy imports. Bangladesh may also see softer future textile growth as transition from Least Developing Country (LDC) status could impact its access to the EU, its major textile consumer market.

A.1.1. Current market for wool

Wool in Bangladesh is largely a niche input. This in part reflects its relatively small sheep population with a flock of 2.3 million in 2020 (0.2% of the global total). However, it also reflects a textile industry that is largely focussed on Ready Made Garments (RMG). Between 2000 and 2021, Bangladesh imported just US$29.9 million in greasy, or early-stage processed wool with trade in recent years relatively stable at US$0.6 million per annum (Chart A.1).

Chart A.1: Bangladesh greasy and clean wool and wool tops by selected supplier



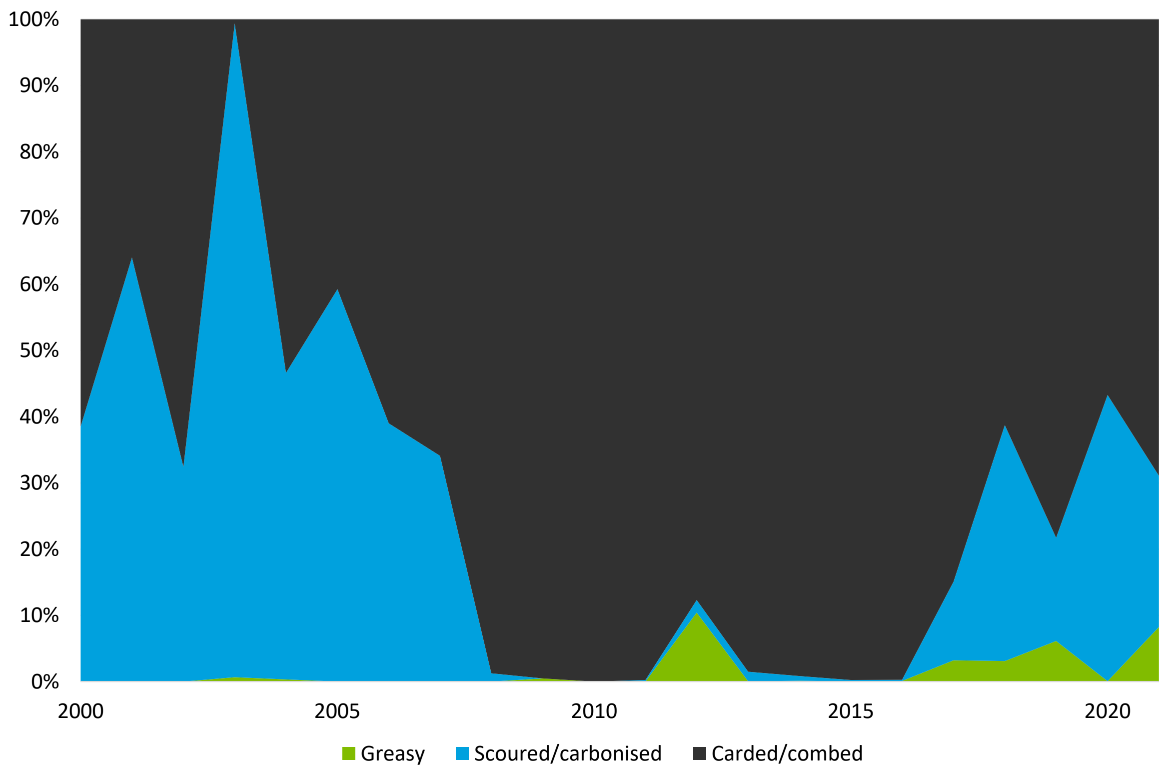
Source: UN Comtrade (2022).

Note: Imports of HS codes 510111; 510119; 510121; 510129; 510130; 510510; 510521; 510529, where Bangladesh is the reporter.

According to AWI there exists little to no early-stage processing or manufacturing of wool products in Bangladesh.[xlix] The limited presence of wool in Bangladesh's textile industry is demonstrated by a ratio of wool imports to textile industry value added. For Bangladesh, the ratio is estimated at around 0.0003%, around one-twentieth of that for China (0.0063%).

While modest, most of Bangladesh's wool imports are carded or combed wool which accounts for around two-thirds of the total. The remainder consists of clean wool but is a fraction of that imported in the early 2000s. The structure of wool imports reflects Bangladesh's current focus on the RMG industry where already processed wool has only a modest integration.

Chart A.2: Share of Bangladesh wool imports, by product



Source: UN Comtrade (2022).

Note: Imports of HS codes 510111; 510119; 510121; 510129; 510130; 510510; 510521; 510529, where Bangladesh is the reporter.

China is Bangladesh's single largest supplier, accounting for around a third of the total, followed by New Zealand (19% of imports in 2020), although trade has only emerged in recent years. Recent trade from Australia and South Africa has been negligible, although Australia was a dominant supplier before the global financial crisis. During this time, Australia's exports were carbonised wool with a micron of between 20 to 23 μm.

Recent trade is a fraction of that imported before 2016 during which wool imports grew relatively to total around $US3.3 million. Virtually all the growth at that time was from Argentina, from which wool exports rapidly expanded then ceased. Trade from China has been smaller in recent years than it was between 2010 and 2015, although it is the only region that has had consistent trade with Bangladesh in the past decade.

Exports of raw and early stage processed wool are negligible, including in the context of Bangladesh's wool imports. In the five years to 2021, Bangladesh imports averaged less than US$100,00 per annum indicating wool imports are almost solely utilised within Bangladesh's textile industry.

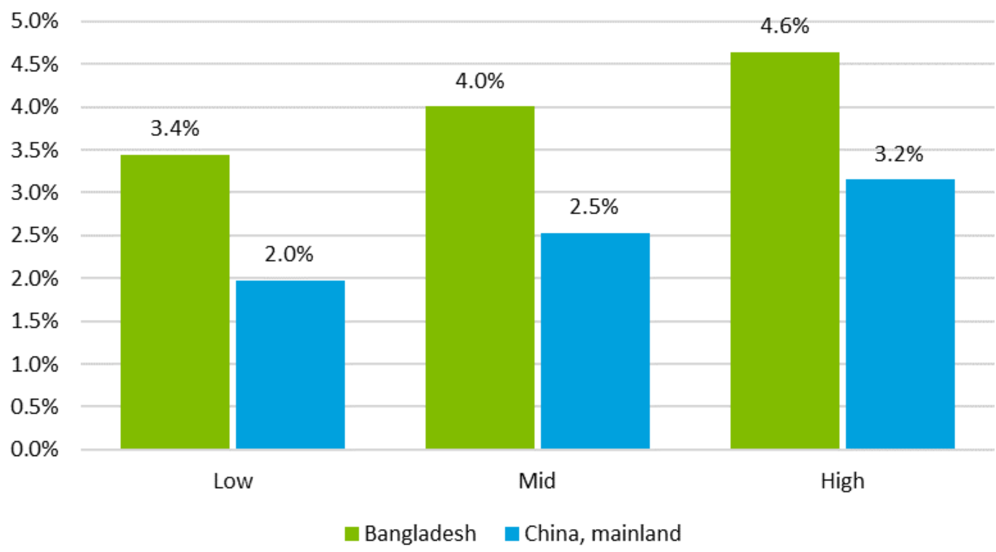
A.1.2. Future textile demand

While current trade in wool for Bangladesh is modest, there is anticipated to be significant potential to further develop the market over the long term. AWI for instance stated in a recent assessment of the market *"We believe there is potential for more wool production in this market within the flat bed knitting and circular knitting industries."*.

The future potential for wool is underpinned by continued expected strong growth in the country's textile sector over the medium to long term. Between 2025 and 2050, Bangladesh's textile industry is projected to grow at between 3.4% (low scenario) and 4.6% (high) per annum. This is more than double the projected rate for China's textile industry and reflects a rapidly expanding economy and assumed increases in manufacturing's share of the economy.

In support of the long term projected strong growth, Bangladesh's long term development strategies focus on diversification away from the RMG industry. Vision 2041 for example includes policy support for emerging sectors, such as high-end RMGs, but also other industries such as pharmaceuticals and shipbuilding.[43]

Chart A.3: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

Reflecting the projected expansion in Bangladesh, by 2050 it is estimated that its share of global manufacturing could be double (mid scenario) its current share of 0.3% and its share of global textile value added could increase to 4.7% (up from around 3.0% in 2021). This, combined with a wool processing supply chain that currently feeds the domestic textile industry is assessed to be of limited risk from changes to current downstream consumers of Australian wool.

This growth is underpinned by an assumed continued expansion in the broader Bangladesh economy that has to date been largely driven by the expanding RMG industry. Between 2005 and 2020 value added in the textile and clothing industry increased by over 20-times. During this period, that industry's share of manufacturing value added also rose in lockstep, rising from a relatively high 20% to account for around 57% in 2020.

Much of the growth in Bangladesh's textile industry has been driven by foreign investment with firms relocating operations to leverage Bangladesh's relatively low labour costs. Preferential access to the EU market (see section A.1.3.2) via LDC access pathways, has supported the recent history of textile manufacturing. In 2021 the United Nations approved a resolution to graduate Bangladesh

[43] Vision 2041, like the National Industrial Policy (2016) is also focused on Small and Medium Enterprise (SME) development that promotes sustainable and inclusive industrial growth.

from LDC status in 2026 which is expected to affect the country's access to the high value consumer market.[l] As such longer-term growth is likely dependent on wider reforms required to promote improved productivity and labour value added, with a key risk of reduced foreign capital inflows.

A.1.3. Trade and market access

A.1.3.1. Trade and investment openness

Reflecting the structure of its economy around textiles, Bangladesh's is relatively open to trade. Exports of these goods experienced relatively consistent growth since 2011, increasing from 87.9% of merchandised exports to 89.6% in 2018.[44]

Alongside the export exposure of the industry, Bangladesh has a liberal and investor-friendly investment regime, offering incentives to various sectors under many schemes (Section 2.4 and Section 3.3.1.2). This has resulted in a steady inflow of foreign direct investment (FDI), from approximately USD 1.2 billion in 2011-12 to nearly USD 2.6 billion in 2017/18

A.1.3.2. Trade agreements and tariff access

Bangladesh has few free trade agreements (FTA), which are mainly linkages with near neighbours, particularly India. China, along with other countries, is engaged in a multilateral agreement with Bangladesh known as the Asia Pacific Trade Agreement (APTA). Concessions provided by Bangladesh under the APTA appear limited to products from other animal hair other than wool. For example, the Fourth Round of Negotiations provided agreement partners with a margin of preference of:

- 35% for carded yarn of fine animal hair
- 20% for woven fabrics with 85% or more combed wool of fine animal hair

Australia's trade with Bangladesh is small but emerging. In 2022 Bangladesh and Australia signed a Trade and Investment Framework Arrangement (TIFA) in 2022 which is a brief statement of intent from both countries that is not legally binding. Under the TIFA, a Joint Working Group (JWG) will be formed to consider all aspects of increased trade and investment in both Bangladesh & Australia.

Both Australia and China are assessed as facing Most Favoured Nation (MFN) tariff rates for exporting wool products into Bangladesh. A summary of Bangladesh's tariffs on greasy wool and processed wool is described below with both China and Australia facing a flat 5% tariff across greasy, clean and tops. Were one party to gain preferential access to Bangladesh via a bilateral or multilateral agreement, a relatively significant tariff advantage would therefore be achieved, posing a relative opportunity to future trade.

Table A.1: Bangladeshi tariff rates for imported wool products, Australia and China (%)

	Australia	China
Greasy wool	5	5
Scoured wool	5	5
Carbonised wool	5	5
Carded wool	5	5
Combed wool	5	5

Source: World Bank (2022).[li]

Bangladesh does not have preferential access to the US market, but it does have access to the European Union. As a Least Developed Country (LDC), Bangladesh benefits from the most favourable regime available under the EU's Generalised Scheme of Preferences. This arrangement

[44] This high concentration of economic production has prompted economic and trade policy discussions regarding economic diversification.

provides duty-free, quota-free access to the European Union for exports of all products, except arms and ammunition. Reflecting this access, Bangladesh is the EU's major trading partner accounting for 19.5% of trade.

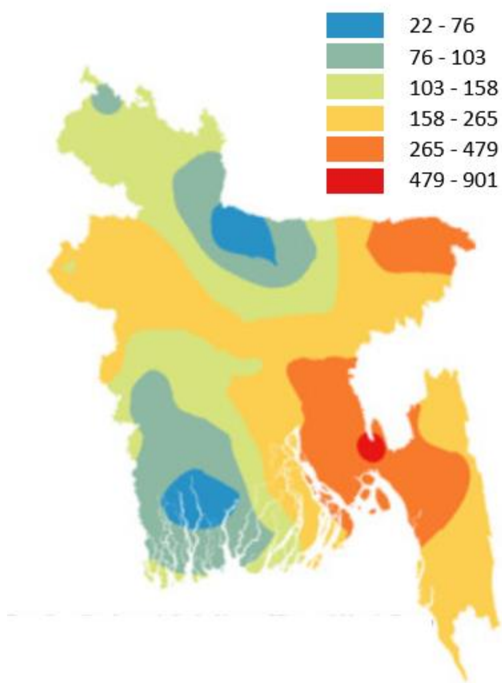
According to the United Nations, Bangladesh is scheduled to graduate from LDC status in November 2026.[lii] While graduation reflects ongoing economic growth, it necessarily implies that certain exemptions allowed under WTO trade and IP rules can no longer be claimed. One recent study found that prices for Bangladesh's pharmaceutical exports may increase by around 150% upon LDC graduation.[liii] In addition to price effects, it is possible that Bangladesh's trading focus may shift, with other larger markets such as the United States, being more attractive in absence of EU LDC access.

A.1.3.3. Sanitary issues related to animal disease events

Bangladesh is assessed as not having strict non-tariff measures that relate to animal health issues on imports. This reflects the relative frequency with which animal disease issues are known to occur in Bangladesh, limited coordination of control measures and relatively transmissible boundaries.

Bangladesh has had numerous incurrences of FMD and it is endemic within its domestic livestock population.[liv] Frequent outbreaks of FMD are understood to occur across Bangladesh districts each year, but there is no published reporting of outbreaks. Outbreaks are particularly frequent in the lead up to the monsoon, with cumulative FMD incidences between 2014 and 2018 illustrated in Figure A.1.

Figure A.1: Bangladesh predicted cumulative FMD incidence map



Source: Rahman et al. (2020).[lv]

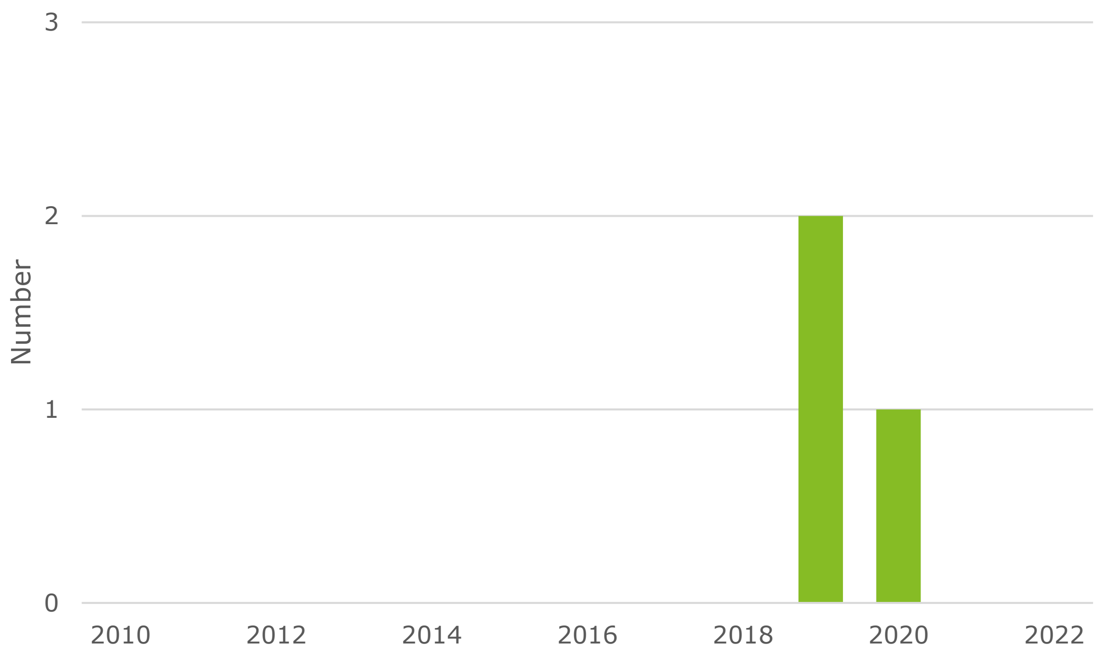
FMD vaccines are available in Bangladesh, and the country has increased its surveillance and control efforts since 2013, when reviews were undertaken.[lvi] However, there is no approved strategy for FMD control in Bangladesh. Control measures that are employed are contained to Department of Livestock Services emergency vaccination at outbreak sites.

Conscientious farmers use vaccines routinely in crossbred cattle against FMD. However, this is likely to remain a relatively limited avenue for control, with the cost of treatment understood to be particularly high. Cross border (informal and formal) and uncontrolled within-country animal movement are important risk factors for FMD transmission in Bangladesh. Given this, and the relative frequency and dispersal of annual outbreaks, achieving freedom from FMD in the near future appears unlikely.

A.1.3.4. Other non-tariff measures

Bangladesh does not impose any specific non-tariff barriers on wool or Australian imports. This is consistent with other countries analysed. Compared to other countries, Bangladesh has notably fewer NTMs. This broadly reflects the country's low income developing status. According to the World Trade Organisation (WTO), Bangladesh only applies technical barriers to trade (TBT) of these, only 5 trading partners are affected (i.e. the European Union, United States and the Republic of Korea Chart A.4). These TBTs were implemented by Bangladesh between 2019 and 2020 indicating a relatively greater propensity for use, although additional NTMs were introduced in 2021.

Chart A.4: NTMs initiated and in force, 2010 to 2021, Bangladesh



Source: WTO (2022).[lvii]

A.1.4. Other barriers

This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced were Australia's wool industry to engage more strongly with Bangladesh. In particular, regulatory barriers are discussed, including labour market regulations and construction and business development regulations, as well as commercial barriers.

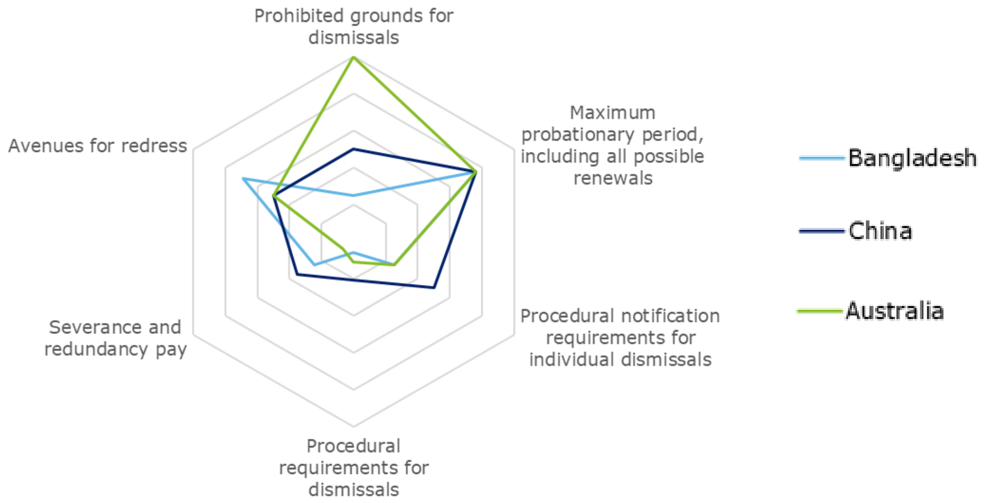
A.1.4.1. Regulatory barriers

Regulatory barriers of particular importance for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues.

The results for Bangladesh are described in Chart A.5 and Chart A.6 and demonstrate that labour market regulations are broadly comparable to that in Australia or China, but barriers to establishing a business may exist (when compared to the former countries).

For labour market regulations (Chart A.5), Bangladesh compares favourably to Australia and China across most indicators. The main exception is prohibited grounds for dismissals where Australia and China score higher in protections for employees against termination unless for valid reasons.[lviii] Bangladesh scores above Australia and China in Maximum probationary periods (including all possible renewals) indicating greater protections for workers otherwise excluded via exemptions that apply to probationary workers.

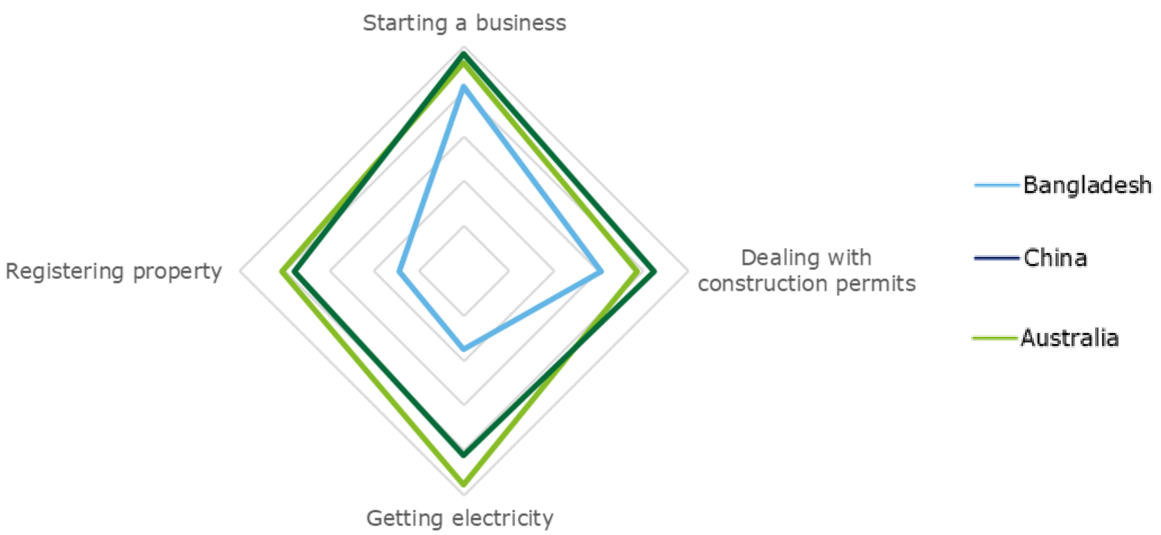
Chart A.5: Indices of labour market regulations, Bangladesh, China and Australia



Source: ILO

Regulatory barriers that apply to business development and construction are assessed as being higher than that in Australia or China. This is particularly the case for property registration and getting electricity, where Bangladesh scored 29 and 35 respectively in the World Bank's Doing Business survey. This is around less than half the average score for China or Australia. Bangladesh also scored lower than China and Australia in Starting a business (82) and dealing with construction permits (61), although scores here are considerably higher than other business development aspects in Bangladesh and are closer to that registered for Australia and China.[lix]

Chart A.6: Indices of construction and business development regulations, selected countries



Source: World Bank (2020).[lx,45]

[45] The World Bank doing business report was discontinued in 2021 due to data audits and reviews into data irregularities. Identified irregularities include data for China as covered here, but for the year 2018. More information is provided by the World Bank at

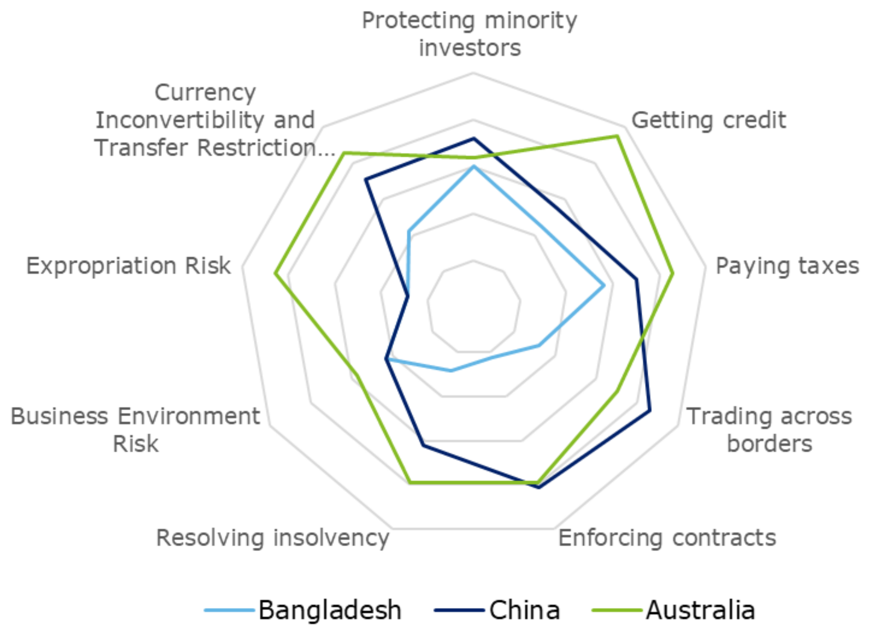
A.1.4.2. Commercial and cultural barriers

While engaging in trade with Bangladesh, it is important to note the cultural and commercial differences when engaging in business operations. From a commercial perspective, it must be noted that tariffs and duty rates are frequently revised and are subject to change without notice. Furthermore, when travelling to Bangladesh, the Australian Government Department of Foreign Affairs and Trade (DFAT) emphases the need to exercise a high degree of caution, due to the high threat of terrorist attack.[lxi] Business culture in Bangladesh is far more formal than Australia, with many cultural customs playing a role in day-to-day activity. In order to successfully engage in business in Bangladesh, it is imperative that these cultural practices be observed.

Reflecting the unique operating environment in Bangladesh, a range of commercial barriers for the existing wool supply chain are likely to exist. While none identified are assessed as materially significant restrictions, scores presented below highlight the challenging commercial environment the wool supply chain may face in seeking to diversify via greater integration with Bangladesh. Selected indicators that illustrate the challenges of operating in Bangladesh are described in Chart A.7.

Compared to Australia or China, Bangladesh scores lowest in terms of enforcing contracts and trading across borders for which Bangladesh scores. These indicators highlight that there are likely significant challenges for business in terms of both the time and cost to resolve commercial disputes and progress logistics through export and import processes. For these indicators Bangladesh scored 22 and 28 respectively, around a third of that registered by China. Bangladesh also scored relatively low in terms of expropriation risk (29) and Business Environment risk (32) but at a level consistent with that for China.

Chart A.7: Indices of commercial factors, Bangladesh



Source: World Bank and Credendo (2022).[lxii]

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https://www.worldbank.org/en/news/statement/2021/09/16/world-bank-group-to-discontinue-doing-business-report

A.2. Czechia

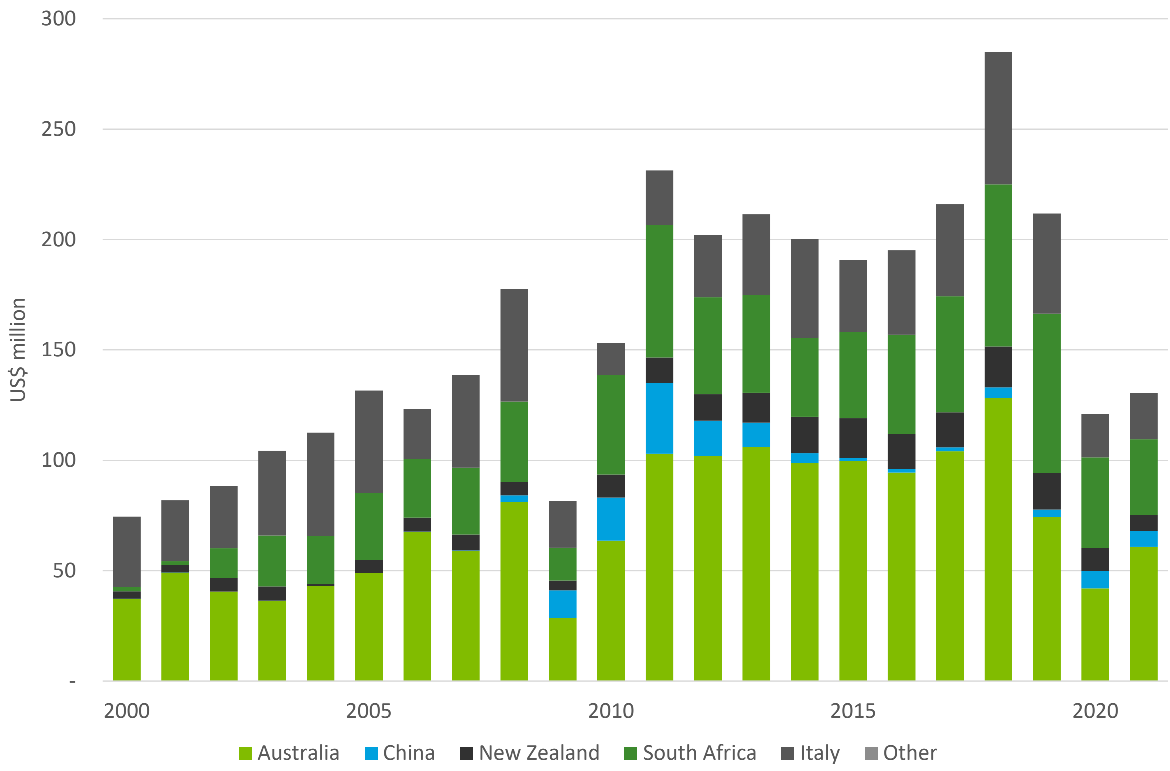
The Czech Republic, also known as Czechia, is an advanced manufacturing economy, with a strong history of importing wool, processing and textile manufacturing that predominantly feeds into the EU market. Wool imports are predominately greasy and Australia is a dominant supplier, and many goods produced with Australian wool are on-sold to EU consumers. While the market provides relatively good access, including in the face of animal disease risks, Czechia's wool processing is highly concentrated and not expected to grow significantly in the future. For this reason, the market is considered a more limited long-term opportunity to diversify the wool supply chain, and likely limited only to greasy exports.

A.2.1. Current market for wool

Wool is an important part of the Czech textile and clothing sector, despite the local flock in 2020 totalling only around 200,000 sheep, virtually all of which are meat breeds. The only wool processing company is Nejdecka cesarna vlny (Nejdek Wool Combing), a subsidiary of G. Modiano Ltd. (Modiano), a wool merchant and top maker with a significant global presence. Nejdek Wool Combing is Modiano's only processing facility with an annual capacity of 23 million kg (basis top & noil).

Reflecting a dominance of greasy wool, Australia and South Africa have central roles in the Czech supply chain. Imports from both markets have expanded over the long term with moderate inter year variability. In 2019 Czech imports from South Africa (US$70.0 million) and Australia (US$60.4 million) were moderately lower than the previous year (US$77.7 million and US$111.0 million respectively) but have been broadly rising over the longer term. (Chart A.8).

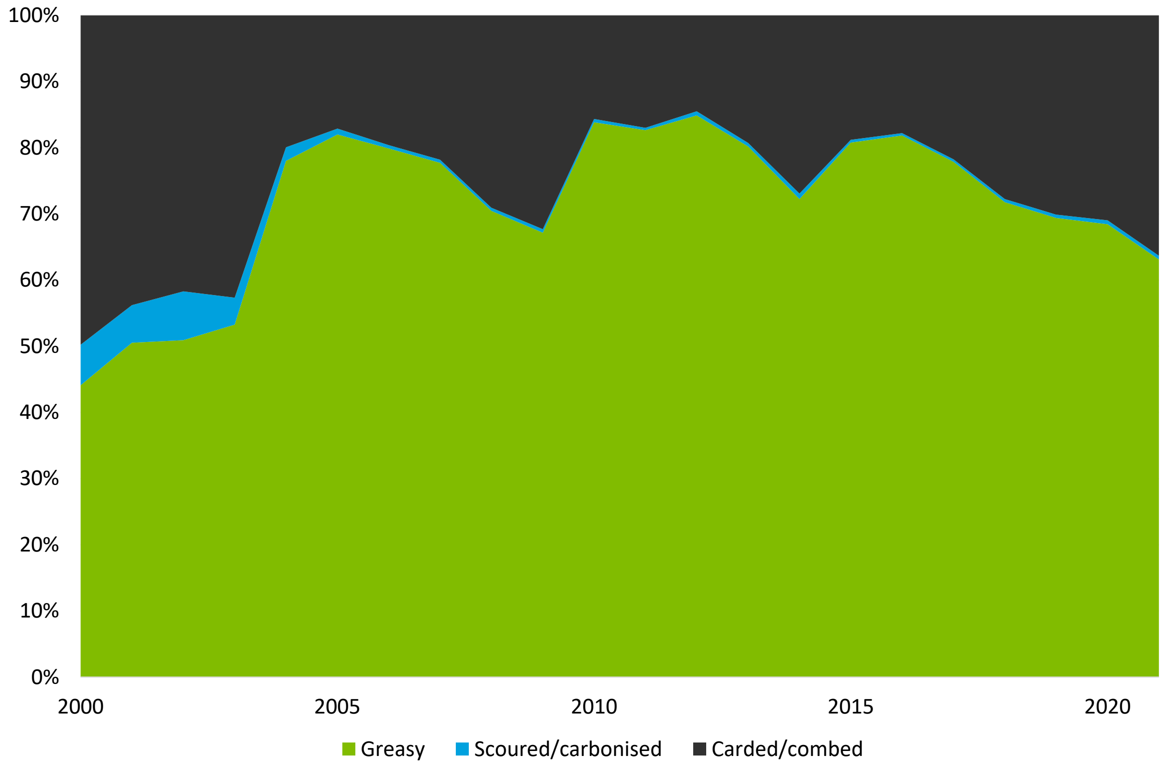
Chart A.8: Czech Republic wool imports by supplier



Source: UN Comtrade (2022).

Most of Czechia's wool imports are greasy, with the remainder being carded or combed wool. While shares have varied over time, greasy wool has accounted for between 70% to 85% of total imports in the decade to 2021 (Chart A.9). Wool tops accounted for a greater share in 2021 (around a third of imports), although this likely reflects recent supply chain disruptions including from COVID-19.

Chart A.9: Share of Czech Republic wool imports, by product



Source: UN Comtrade (2022).

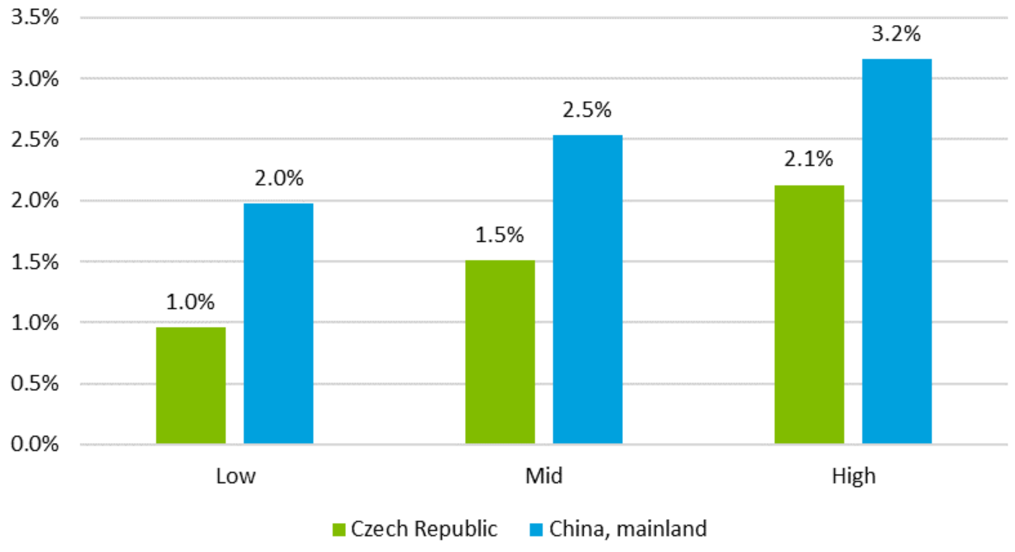
Czech exports of greasy and early-stage processed wool are broadly similar to the value of imports. This is because the industry is focused on supplying spinning enterprises mainly in Europe. Nejdek Wool Combing supplies a selected number of processors in Czechia before yarn and fabric is exported. As such Czechia's existing supply chain is somewhat exposed to risks from the relocation of spinning (and other downstream customers). This risk is assessed as modest though given the proximity also to the EU market and some relocation potentially including near-shoring.

A.2.2. Future textile demand

Given the concentration of the Czech market, a significant expansion in Australian exports, greasy or otherwise, is not anticipated. Czechia will likely remain focused on the EU market for its output, and as a relatively mature market is unlikely to see significant growth beyond current levels for spun yarn. Indeed while future strategies are particularly interested in Czechia as a manufacturing base for the EU, many of the firms are foreign investments, creating challenges for broader government and industry strategy and priorities.

In addition to the above challenges, the Czech textile market is mature with only moderate growth projected over the medium to long term. Between 2025 and 2050, Czechia's textile industry is projected to grow by between 1.0% (low scenario) and 2.1% (high scenario) per annum which is half to two thirds of the projected rates for China (Chart A.10). By 2050 it is estimated that Czechia's share of global manufacturing could gradually decline (mid scenario) from its current share of 0.39% and its share of global textile value added is also expected to decline to around 0.1% (down from around 0.15% in 2021).

Chart A.10: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

The modest future growth potential for Czechia's textile industry is in part reflected in the country's industrial and strategy policies (which broadly mirror the objectives of the EU market). The Strategic Framework Czech Republic 2030 (released in 2020) focuses on the recovery of COVID-19 and reinforces environmental and sustainability issues. Future growth objectives stated in the report include finding 'new sources of growth', and decoupling from models underpinned by energy consumption, material use and foreign investment.

A.2.3. Trade and market access

The Czech Republic is an active member of the European Union and currently holds the presidency for the block. As a member of the EU, it has freedom of movement for goods across any EU country border through its customs union. The county is an important market for central Europe with extensive trade routes to eastern and western Europe.

As a member of the EU, the Czech Republic is bound by environmental and trade standards of the block. With progressive policies regarding traceability and impending emissions regulations, goods entering the Czech Republic like elsewhere in Europe will be subject to stringent inspection.

A.2.3.1. Trade and investment openness

As a part of its financial support for private investments, the Czech Republic provides several aid programs for both Czech and foreign investors. These programs focus on a variety of areas of business and are financed from European Union structural funds – from the Enterprise and Innovation and Human Resources and Employment Operational Programs – as well as from the Czech Republic's national budget in the form of investment incentives. Between 1998 and 2015, a total of 21 garment industry investment projects have been supported (from a total of 951 projects).

A.2.3.2. Trade agreements and tariff access

The Czech Republic and the EU more broadly maintain low applied and marginal tariffs on imports of wool products. Australia does not have preferential access to the EU market but faces no tariff on greasy or clean wool. A tariff of 2% is applied to carded or combed wool. A summary of the EU tariffs on greasy wool and processed wool is described below.

Table A.2: EU import tariffs for wool products

	Australia	China
Greasy wool	0	0
Scoured wool	0	0
Carbonised wool	0	0
Carded wool	2	2
Combed wool	2	2

Source: World Bank (2022).[lxiii]

A.2.3.3. Sanitary issues related to animal disease events

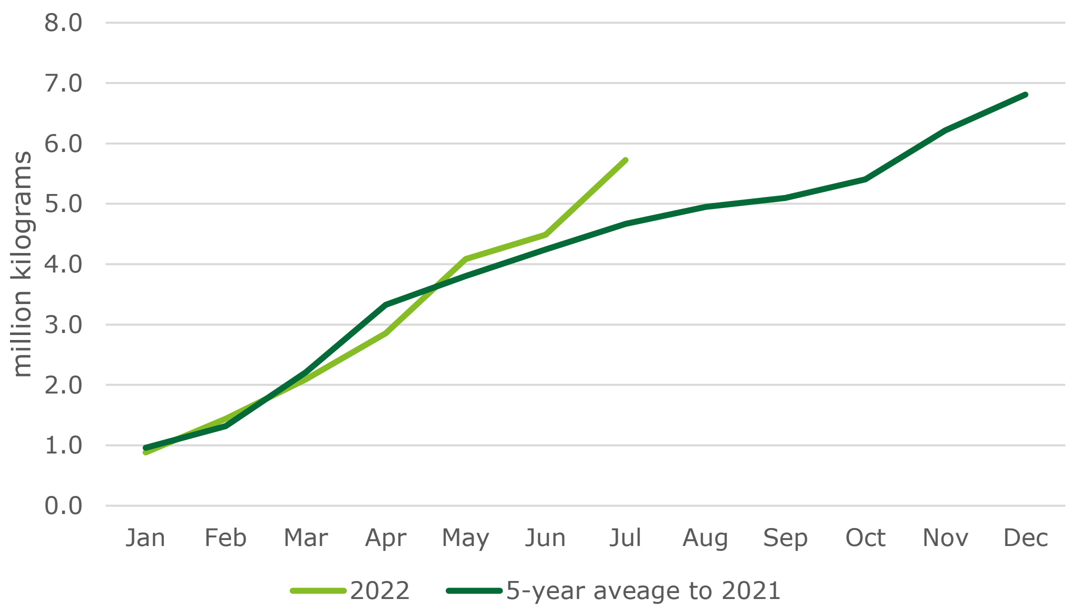
Czechia's non-tariff measures relating to animal health issues are consistent with international agreed principles. Czechia has been FMD free since 2006 and is currently recognised by the Australian government as one of 44 FMD-free countries.[lxiv]

The EU was an active participant in developing the World Organisation for Animal Health's (WOAH) Terrestrial Animal Health Code, including aspects of Article 8 that relate to the importation of wool from countries or zones affected by FMD.[lxv] The code recognises that FMD can be inactivated by:

1. industrial scouring which consists of the immersion in a water-soluble detergent held at 60-70°C
2. storage of wool at 4°C for four months, 18°C for four weeks or 37°C for eight days

In the event of an animal disease outbreak, it is assessed that the EU would adhere to these guidelines and allow the importation of appropriately treated greasy or clean wool. This is reflected in the continuation (and advanced) trade with European Union countries after an FMD outbreak in South Africa in early 2022. Between January and July 2022 Czechia imported 5.7 million kilograms of wool from South Africa with trade largely in line with the average of the previous five years. Imports in July were considerably above average leaving cumulative year to date imports for 2022 22% above the average of the 5-years to 2022.

Chart A.11: Cumulative greasy wool imports of South African wool, Czechia, 2022 and average of 5-years to 2021



Source: UN Comtrade (2022).

A.2.3.4. Other non-tariff measures

As a member of the EU market, trade with Czechia is subject to an array of NTMs. While few NTMs apply specifically to wool, the EU employs around 200 SPS and TBT NTMs in force as of 2021. According to the United Nations, Czechia's use of NTMs is relatively strong. Across agriculture and manufacturing, Czechia's NTM frequency index and coverage ratio are high and close to 1.0. The Frequency Index indicates the simple presence (or absence) of NTMs, capturing the percentage of affected imported products. The Coverage Ratio captures the share of trade subject to NTMs. The scores for Czechia's NTM indicators are consistent with broader trends across high income countries, where NTM coverage is relatively high covering most areas of trade. The prevalence of NTMs in Czechia is also high with an average of 15.5 NTMs applying to agricultural products, and 5.0 applying to manufactured goods.

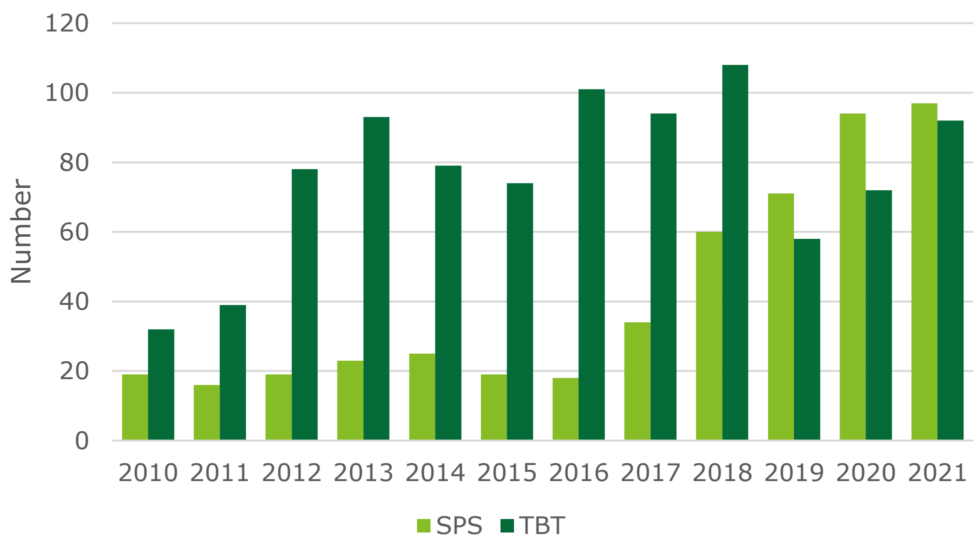
Table A.3: Agriculture and Manufacturing NTM indicators, selected countries.

	Czechia	China	Australia
Agriculture			
Frequency index	0.98	1.0	0.98
Coverage ratio	0.98	1.0	0.98
Prevalence score	15.5	22.8	16.1
Manufacturing			
Frequency index	0.92	0.89	0.63
Coverage ratio	0.89	0.90	0.72
Prevalence score	5.0	5.4	2.1

Source: UNCTAD (2022).[lxvi]

The large number of NTMs is in line with other developed countries such as the United States and Japan. In addition to NTMs imposed by the EU, Czechia has a total of 83 measures in force (and an additional 354 that have an initiation date but not in force). The vast majority of Czech NTMS are TBTs. The number of barriers imposed over the last 10 years has varied with 2010, 2018 having the largest number of 25 TBTs.

Chart A.12: Number of EU SPS and TBT NTMs in force, 2010 to 2021



Source: WTO (2022).

In the EU, use of NTMs has increased over time. Between 2010 and 2021 the number of SPS and TBTs increased more than 3-fold with the total number of NTMs in force. The number of technical barriers has varied since 2010 after initially increasing significantly, while SPS barriers have increased substantially since 2016.

The proliferation of NTMs in the EU is expected to continue to rise over the longer term, imposing more substantial restrictions on market access for exporters. This includes the textile industry with the EU Strategy for Sustainable and Circular Textiles[lxvii] discussing the promotion of greener and fairer value chains, including worker conditions, as well as circular economy principles such as textile waste.

A.2.4. Other barriers

This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced by Australia's wool industry if it engaged more strongly with Czechia. In particular, regulatory barriers, including labour market regulations and construction and business development regulations, as well as commercial barriers.

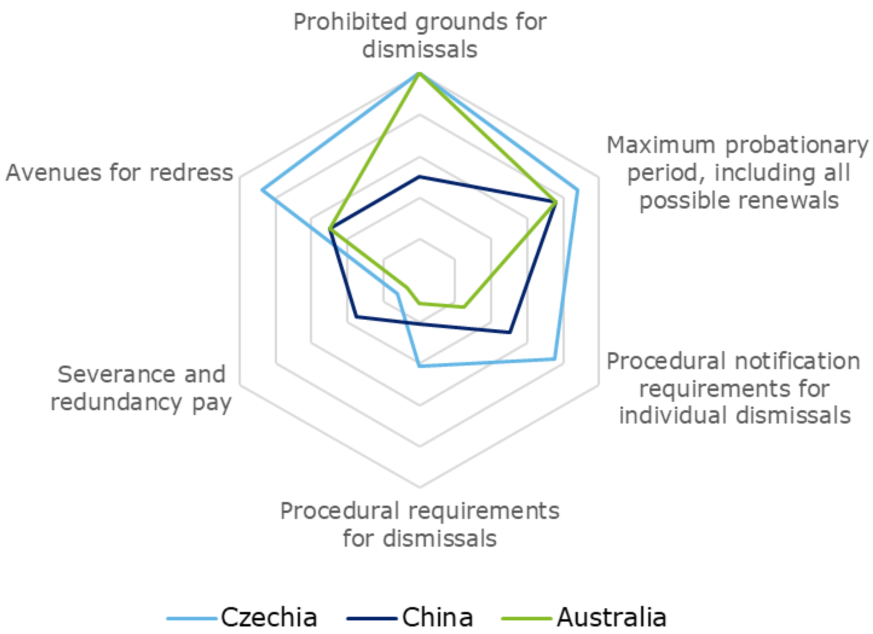
Regulatory barriers are of particular importance for diversification of the wool supply chain through changes to early-stage processing, including labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues.

A.2.4.1. Labour market regulations

The results for Czechia are described in Chart A.13 and Chart A.14 and show that the labour market is more regulated in Czechia compared to Australia and China, while ease of doing business is broadly similar across all three countries.

For labour market regulations (Chart A.13), Czechia is overall more regulated than Australia and China with the exceptions of prohibited grounds for dismissals (on par with Australia) and severance and redundancy pay (more than Australia but less than China).

Chart A.13: Indices of labour market regulations, Czechia, China and Australia

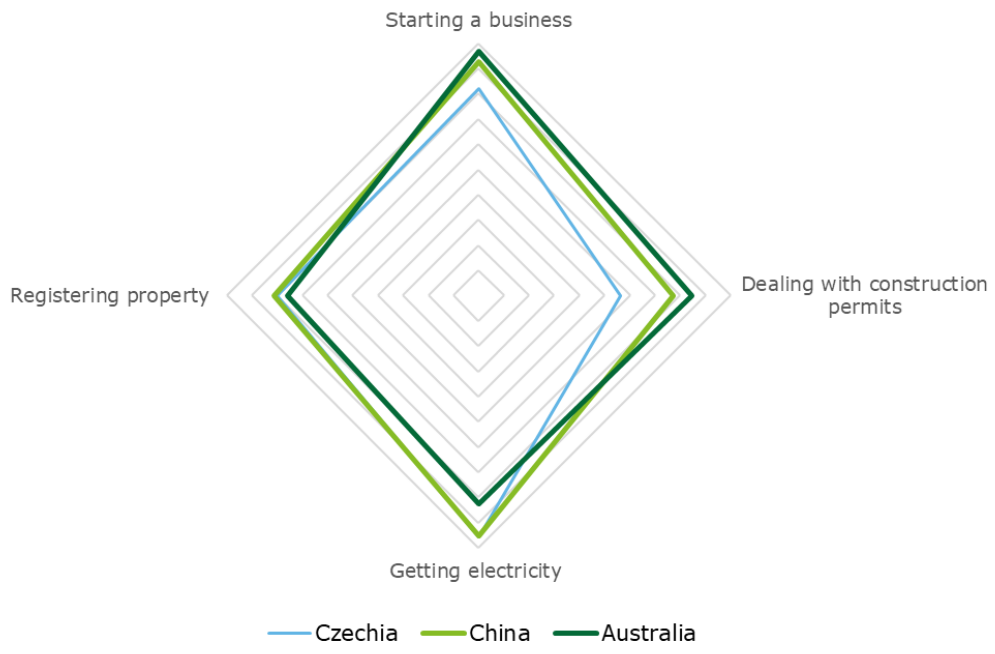


Source: ILO

Czechia's regulatory barriers applying to business development and construction are assessed as broadly similar to that of China and Australia. A minor exception is that it is more difficult to deal with construction permits in Czechia. Czechia scored only 56 compared to China (77) and Australia

(84) in the World Bank's Doing Business survey (Chart A.14). This is around two thirds of the average score for China or Australia.

Chart A.14: Indices of construction and business development regulations, Czechia, China and Australia



Source: World Bank (2020).[lxviii]

A.2.4.2. Regulation of textile wastewater effluent

Industrial wastewater discharge standards in Czechia are administered under the European Union's Urban Wastewater Directive.[lxix] There is a good level of compliance with the effluent discharge standard in Czech, given the high degree of enforcement and policing of regulation in the EU.

The EU adopted a Circular Economy Action Plan (CEAP) in 2020 that aims to drive sustainable growth in Europe and transition the EU to a circular economy. The Plan promotes water use efficiency and recovery across the EU economy in line with broader circular economy principles. Water and wastewater intensive industries are therefore likely to face longer term challenges in meeting growing regulatory strictness in the EU.

Contained within CEAP was a key action to deliver a specific strategy for the textile sector reflecting the complexity of its value chains. The EU commission communicated the strategy in March 2022[lxx] and while much of the strategy focusses on the EU's role as a consumer at the end of global value chains, the strategy states that "*measures will target manufacturing processes… . Further options include… regulations for improved wastewater and sewage sludge treatment*.[lxxi]

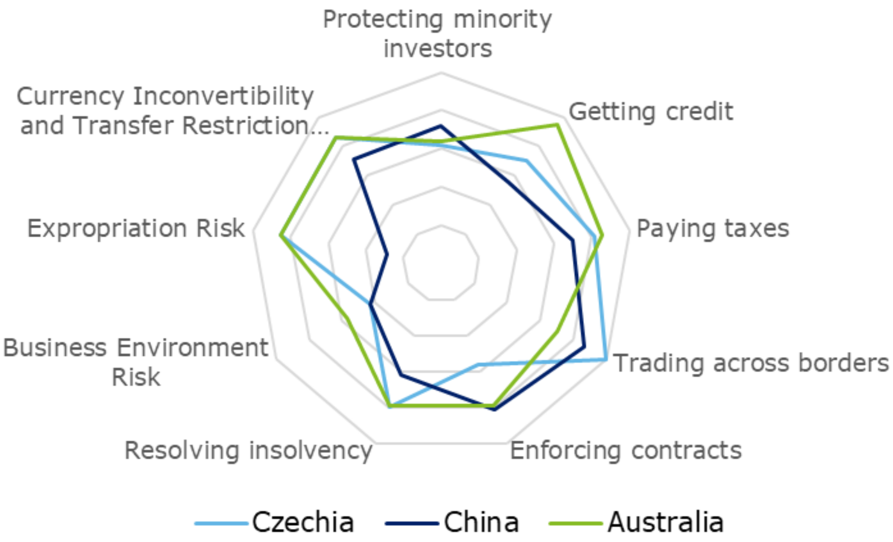
A.2.4.3. Commercial and cultural barriers

Czechia has rapidly transformed to a market-based economy, following the fall of communism in 1989, with a per capita GDP of US$18,325 (2016), and forecasted growth of approximately 3% over the next three years, as a growing key economy in central Europe.[lxxii] Czech business practices are relatively similar to Australia, though they may be more formal at times.[lxxii] Australian companies operating in Czechia often enter through partnerships with a local distributor or business partner. While this collaboration occurs, there is still a strong weight placed on the local involvement of Australian partners.[lxxii]

Czechia is a relatively stable operating environment with commercial barriers for the existing supply chain assessed as minor. None of identified commercial barriers are present materially significant restrictions. Selected indicators that illustrate the challenges of operating in Czechia are described in (Chart A.15).

Compared to Australia and China, Czechia scores the highest for trading across borders (100), due in large part to its integration with the EU. On the downside, Czechia scores significantly lower (56) than Australia and China for enforcing contracts and equally low as China (43) for business environment risk compared to Australia (57). It is also more difficult to get credit than in Australia but easier than in China.

Chart A.15: Indices of commercial factors, Czechia



Source: World Bank and Credendo (2022).[lxii]

A.3. India

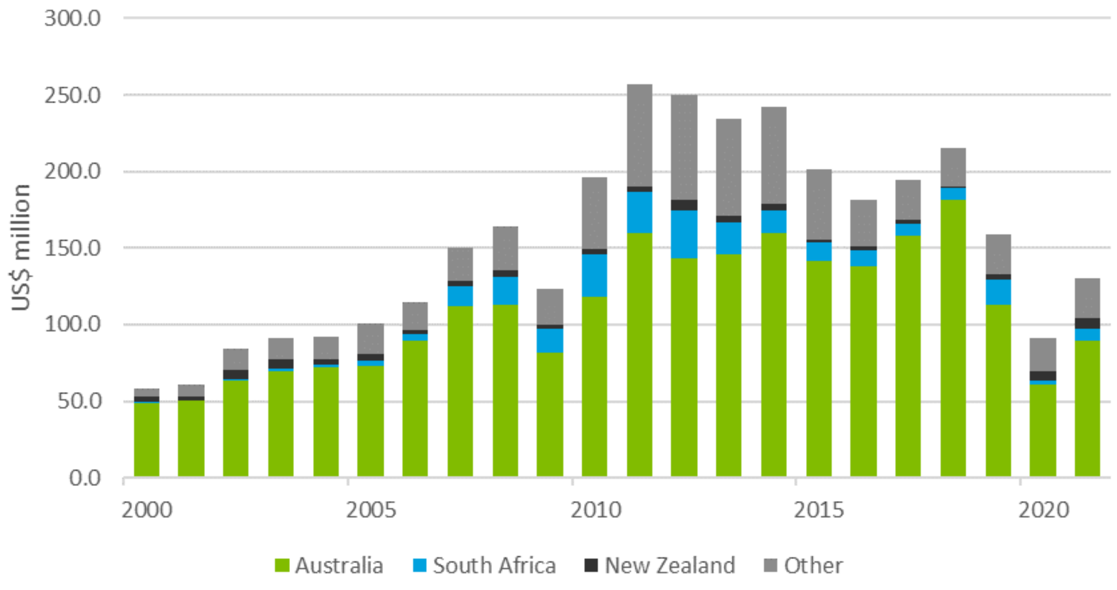
India is currently a key market for wool, both for Australia and the global supply chain. Future growth in the Indian market is expected to remain strong, presenting a significant opportunity for Australian wool. Long term steady growth in India's textile industry is expected, alongside a broader expansion in the economy. In support of the anticipated economic growth, India has a range of government initiatives, and Australia is likely to benefit from preferential access under of a recently announced free-trade agreement. In the case of carded and combed wool, tariffs that are currently between 7.5% and 10% would be reduced to zero over seven years. While India's wool industry has historically focussed on processing broader microns, there is significant potential for use of finer wool. This transition may in part be supported by strengthening government regulation of wastewater which has seen the industry import more processed wool in place of historically dominant greasy product.

A.3.1. Current market for wool

India is a rapidly expanding economy of already significant global importance for wool. Wool imports in 2020 were valued at around US$154 million during which trade was heavily affected by COVID-19. While trade rebounded in 2021 to $210 million it remains around 30% below the 5-year average to 2020. India's early-stage wool processing industry is integrated into local textile and clothing manufacturing. As such, exports of greasy and early-stage wool are relatively modest averaging just US$30 million per annum (around 10% of the value of imports) in the 5-years to 2019.

Most Indian imports are greasy wool, which accounted for around 65-75% of the total between 2007 and 2019. Australia is the dominant supplier of greasy wool for which it accounts for around 85% of the total. Virtually all imports of Australian wool consists of mid microns of between 20 to 23 µm (55.9% of the total quantity imported in the 3 years to 2021) or 19 µm and finer (25.6%).

Chart A.16: India, greasy wool imports



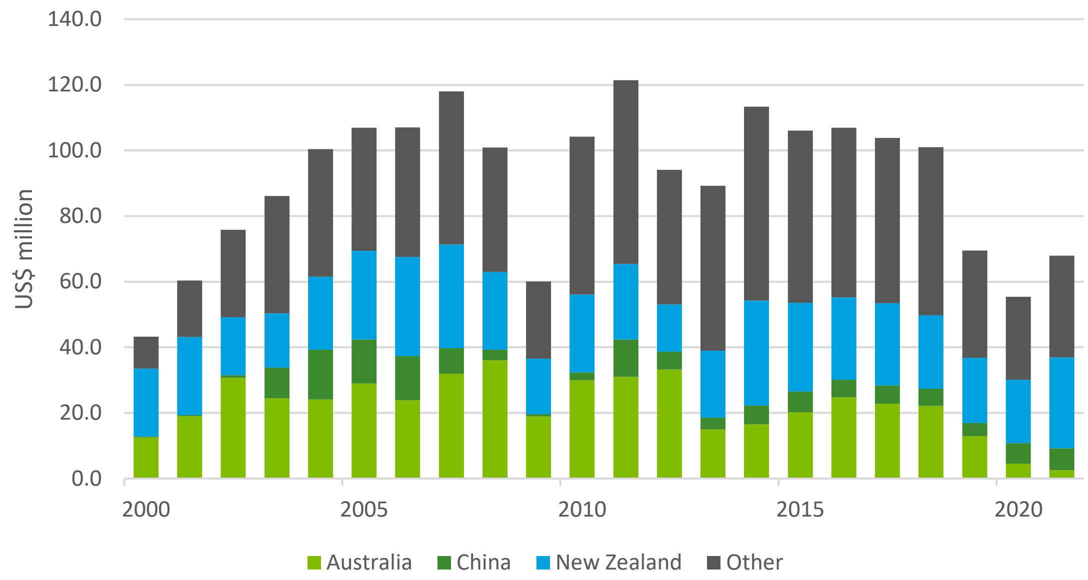
Source: UN Comtrade (2022).

India also takes a significant portion of clean wool with more than $US 60 million imported in 2021 (Chart A.17). New Zealand is the primary supplier and is understood to consist of similarly broader fibre diameters as Australia. The value of clean wool imports has been relatively consistent over the last decade fluctuating between US$30 and US$35 million.

Clean exports from Australia previously accounted for a moderate share of the total supply although trade since the global financial crisis has been a fraction of that before the crisis. Advice provided during consultations indicated that demand from a single large importer has been affected by COVID-19 conditions. A large number of smaller suppliers also export clean wool to

India; however, volumes are small. This is demonstrated by China's position in the market accounting for just 8% of imports in the last five years, compared with its share of global clean wool exports (around a third).

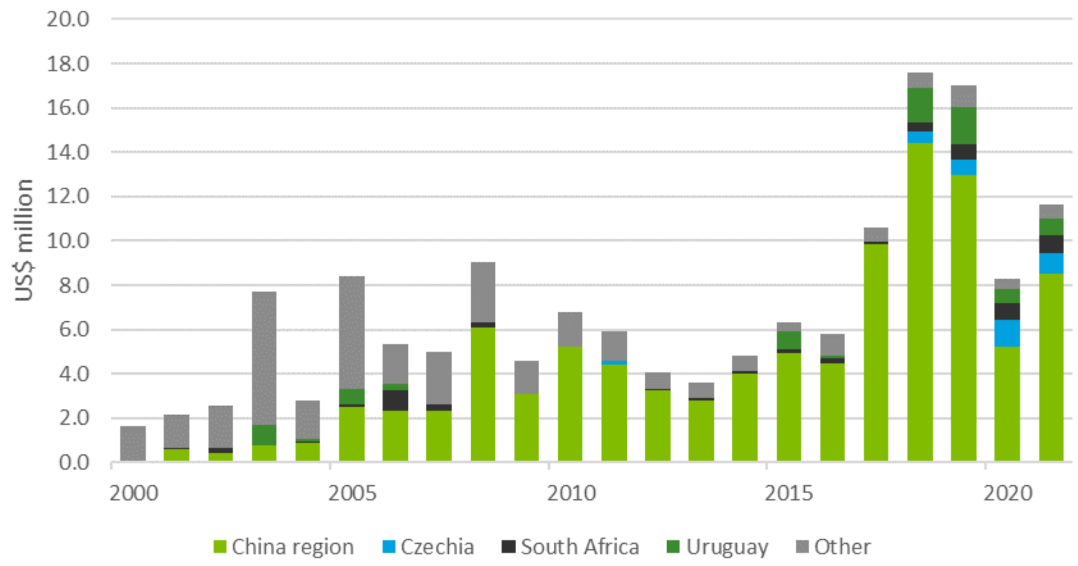
Chart A.17: India, clean wool imports



Source: UN Comtrade (2022).

In contrast to greasy and clean wool imports, India's imports of wool tops have risen substantially in recent years, albeit off a low base. In 2018 and 2019 imports (averaging US$16 million) were around three times that of the preceding 3 years. While COVID-19 saw a contraction in trade in 2021, this appears to have been relatively short-lived, with a robust rebound in 2021 that hasn't been observed in greasy or clean wool. This growth in wool top imports in part likely reflects ongoing uncertainty around Indian textile wastewater regulations (see appendix section A.3.4.2) with demand for wool being preferentially serviced by processed imports.

Chart A.18: India, wool top imports



Source: UN Comtrade (2022).

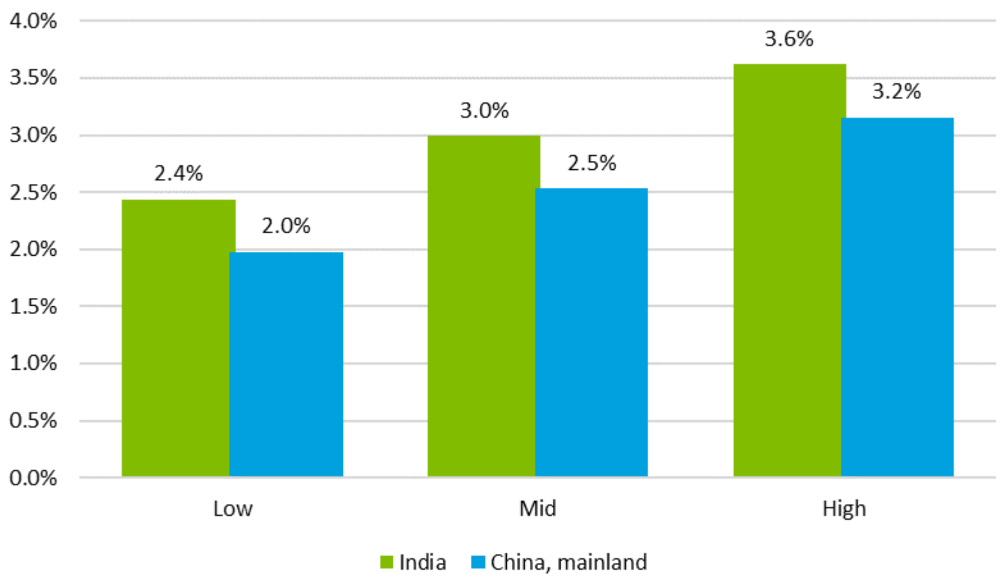
India exports of raw and early stage processed wool are modest, particularly when compared to its imports. In the 5-years to 2021 exports averaged around US$20 million less than 10% of India's average import value during this period. Most exports are carded or combed wool and are shipped to Italy. For this reason, shifts in global spinning and knitting are not anticipated to pose as a significant risk to the Indian market where trade is mostly focused on feeding the large and expanding domestic textile industry.

A.3.2. Future textile demand

While recent growth in Indian use of wool in textile manufacturing has been modest, long term steady growth in demand is expected to be driven by a rapidly expanding economy. AWI for example noted India's potential as both an existing market for woollen products and as having significant potential for growth in worsted processing.[lxxiii] With a 9% share of the global total, India has the second largest installed capacity of spindles behind China.[xii]

The future potential of wool in India is underpinned by continued expected strong growth in the country's textile sector over the medium to long term. Between 2025 and 2050, India's textile industry is projected to grow at between 2.4% (low scenario) and 3.6% (high) per annum. This is around 20% faster than the projected rate for the world's largest textile industry, China, and mainly reflects a broader rapid expansion in the local economy. Reflecting the anticipated strong growth in Indian textile production, India is projected to see its share of global value-added rise from 4.2% to around 5.0% by 2050.

Chart A.19: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

In support of the long term projected strong growth for its textile sector, India has a range of policies and strategies in place. Government initiatives to encourage manufacturing growth include for example the 2011 National Manufacturing Policy[46] which aims to expand manufacturing to account for a quarter of the economy and create over a million jobs.[lxxiv] While the Make in India initiative promotes the development, manufacture and assembly products in India and provides a range of manufacturing investment incentives.[lxxv]

Increasing the footprint of manufacturing (including the textile sector) in the Indian economy has however proved challenging. Manufacturing's share of the economy has remained largely unchanged over the last two decades at 14-16% of GDP, while textile's share of the manufacturing

[46] The 2011 policy continues to apply although the Indian government expects to issue a new Industrial Policy in the near future.

sector has sat at 8-10% of manufacturing sector activity since the mid-2000s. This steady footprint in part reflects structural challenges for the economy and competitive advantages in services sector which has driven much of India's recent economic growth.[lxxvi]

A.3.3. Trade and market access

A.3.3.1. Trade and investment openness

Historically, India's size and the appeal of self-sufficiency have encouraged a degree of insularity. However, in recent decades India has steadily opened itself the global economy. In the five years to 2021, the ratio of trade to GDP was around 43%, comparable to that for Australia, and other significant trading economies, including China and the United States. As outlined in various policy and strategies, India aims to further integrate into the global economy increasing its share of exports and its portion of global trade.

India is an original member of the WTO and has had stable trade policies for the past decade. Throughout this period, India has also prompted numerous investigations into anti-dumping measures (mainly on chemicals and processing inputs).

A.3.3.2. Trade agreements and tariff access

India has historically shied away from signing bilateral trade agreements. The agreements it has entered into are largely with regional neighbours including for example Association of Southeast Asian Nations (ASEAN) countries and Sri Lanka and Afghanistan.[lxxvii] India does not have trade agreements with large wool processors such as China, or large textile markets of the United States or European Union. A comprehensive economic partnership agreement was entered into force with Japan in 2011, and an interim trade agreement was signed in April 2022 between Australia and India (known as IA-ECTA). IA ECTA is subject to ratification by both countries before entering into force and is expected to provide Australian wool with substantially improved tariff access for wool products.

Under IA-ECTA, Australian greasy wool exports are to face no tariffs on imports, down from a currently applied rate of 5%. Clean wool imports from Australia will also see tariff reductions upon entry into force of 5% to 0%. While carded and combed wool are expected to see a larger magnitude but gradual reduction in tariffs over a 7-year period. Currently, carded and combed wool imports are subject to tariff rates of between 7.5% and 10%. Under IA-ECTA, these tariffs are to be reduced to zero, providing Australian processed wool with a significant preferential advantage over other suppliers of carded and combed wool into the market, such as China or New Zealand.

Table A.4: India import tariffs for wool products

	Australia (IA-ECTA)	Australia (Current)	China
Greasy wool	0#	5	5
Scoured wool	0#	5	5
Carbonised wool	0#	5	5
Carded wool	0^	10	10
Combed wool	0^	7.5 - 10	7.5 - 10

Source: DFAT and WTO (2022).

Note: # refers to upon entry into force, ^ refers to after 7 years

A.3.3.3. Sanitary issues related to animal disease events

has non-tariff measures relating to animal health issues that are consistent with international agreed principles. A number of animal diseases are endemic in India, including FMD which is found in many parts of the country.[lxxviii]

The Government of India has been carrying out a foot and mouth disease control program in a phased manner since 2003–2004. The program intends to vaccinate India's globally significant livestock population, initially prioritising cattle and buffalo. The program aims to free the country from FMD by 2030 and follows the protocols outlined by the WOAH and United Nation's Food and agriculture organisation (FAO). By 2017–2018 it was expanded to include all of India's 780 districts with subsequent expansion from 2019 to include sheep, goats and pigs (Table A.5).

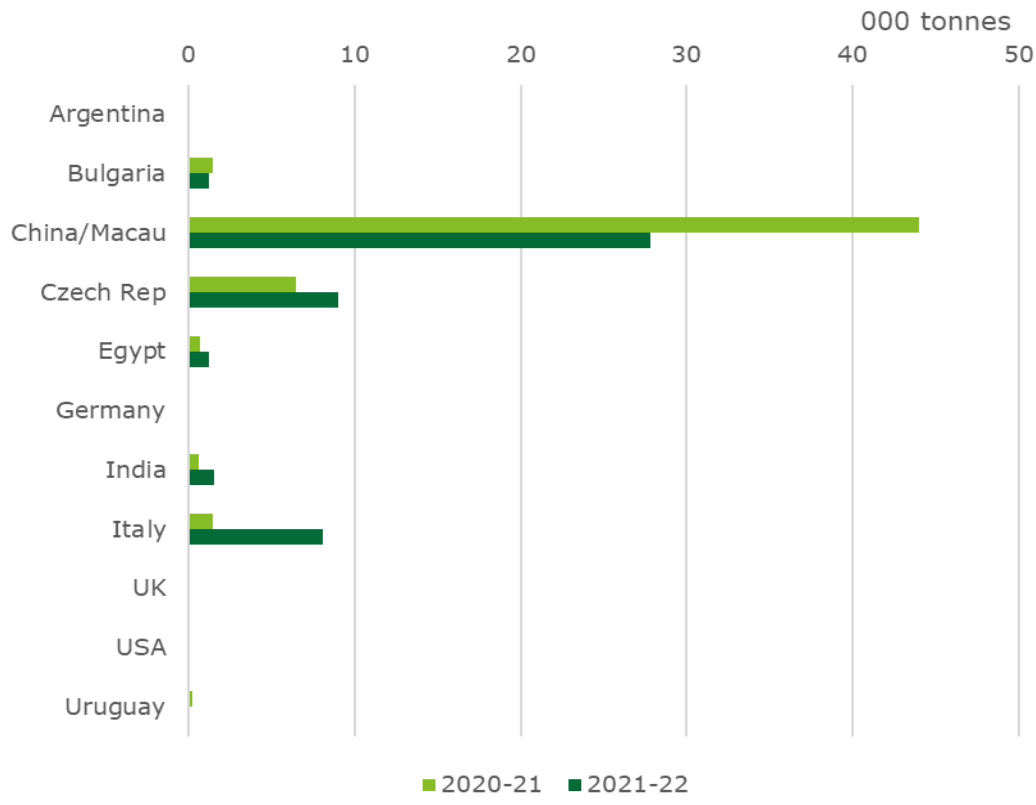
Table A.5: India districts covered in the government's FMD control programme

Year	Districts included	Species covered
2003–2004	54	Cattle, buffalo
2010–2011	Extended to 167 districts	
2015–2016	415	
2017–2018	All	
2019–2024	733	Cattle, buffalo, sheep, goats, pigs

Source: Audarya (2020).

During South Africa's 2022 outbreak of FMD, the Indian government agreed that greasy wool could be imported from regions of the country that were certified as FMD free. This agreement facilitated the continuation of small volumes of trade between the two countries in line with the principles outlined in the OIE's Terrestrial Animal Health Code. South African export data in Chart A.20 shows where a large reduction in exports to China were instead shifted to India and other partners.

Chart A.20: South African greasy wool export destinations, 2020-21 and 2021-22



Source: Cape Wools (2022).

A.3.3.4. Other non-tariff measures

Australian wool imports into India are not subject to specific sanitary requirements. Some technical barriers have been implemented against some HS 51 coded products such as cotton bales and some polyester yarns.

More broadly, India imposes multiple NTMs across both agricultural and manufactured goods although use in agriculture is most substantial. According to the United Nations, India applies NTMs to all agricultural products (frequency index of 1.0) and across all agricultural imports (coverage ratio of 1.0), with scores relatively comparable to that in China. In contrast manufacturing NTMs are used less and comparable in coverage to that applied by Australia. Despite this, the average number of NTMs applied by India is more than double that in Australia.

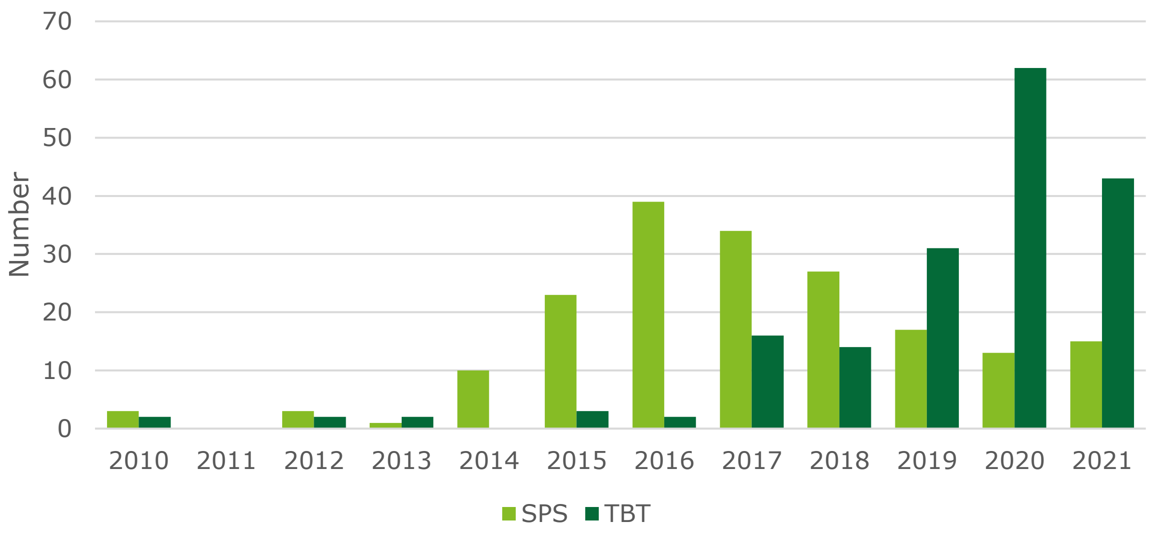
Table A.6: Agriculture and Manufacturing NTM indicators, selected countries.

	India	China	Australia
Agriculture			
Frequency index	1.0	1.0	0.98
Coverage ratio	1.0	1.0	0.98
Prevalence score	23	22.8	16.1
Manufacturing			
Frequency index	0.59	0.89	0.63
Coverage ratio	0.80	0.90	0.72
Prevalence score	5.2	5.4	2.1

Source: UNCTAD (2022).[lxxix]

Most NTMs used in India are anti-dumping measures (141 initiated and 235 enforced in 2021). In 2020 113 NTMs were introduced 92 of which were anti-dumping measures. Technical Barriers to trade and SPS measures have proliferated in recent years, although their use is comparatively modest when compared to markets such as China or the EU. In 2020 for example, 62 technical barriers were in force considerably more than that a decade earlier (2), while 13 SPS measures were similarly higher, the number in force was well below the peak of 39 in 2016.

Chart A.21: Number of Indian SPS and TBT NTMs in force, 2010 to 2021



Source: WTO (2022).

There is potential for Australian exports to face increased non-tariff measures in future trade with India. This is because the use of NTMs is anticipated to rise further, consistent with the path taken by most developing countries. It is anticipated though that use will also likely shift from mainly using anti-dumping measures to SPS and technical barriers.[lxxx] However some protections from burdensome NTMs may be provided through the AI–CETA, which could provide avenues for recourse where trade outside of a bilateral agreement would not and wool is likely to remain a commodity treated distinctly from other livestock products given its manufacturing applications.

A.3.4. Other barriers

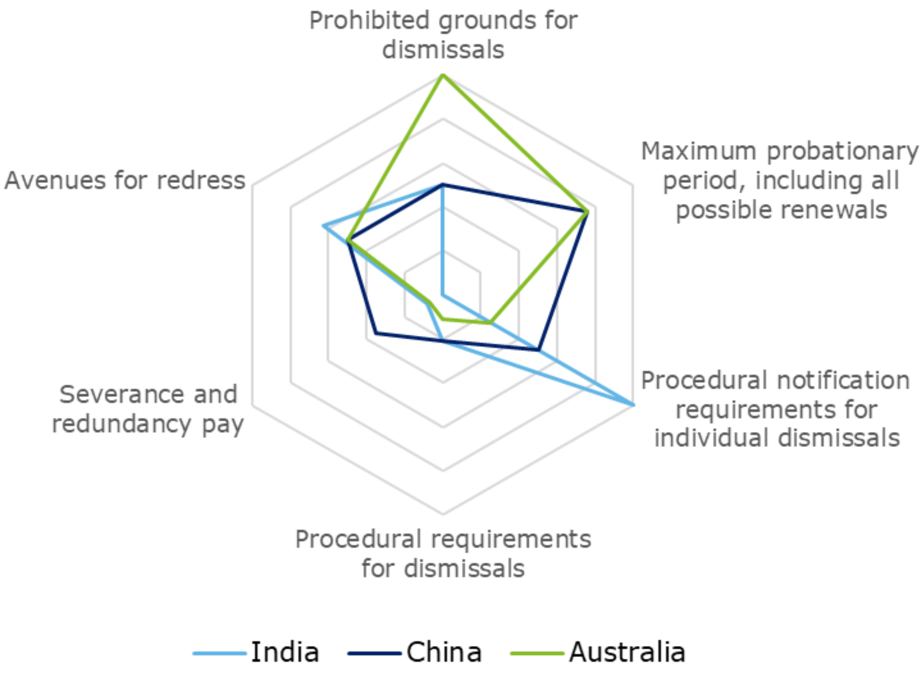
This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced were Australia's wool industry to engage more strongly with India. In particular, regulatory barriers are discussed, including labour market regulations and construction and business development regulations, as well as commercial barriers.

A.3.4.1. Regulatory barriers

Regulatory barriers of particular importance for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues. The results for India are described in Chart A.22 and Chart A.23.

With regard to labour market regulations, India is a very different environment than China and Australia with more than double procedural notification requirements for individual dismissals, but negligible maximum probationary period regulations. Prohibited grounds for dismissals are similarly few in China and India (50) compared to Australia (100) while severance and redundancy pay requirements in Australia and India are similarly low (7) compared to China (35). India also scores noticeably higher on avenues for redress compared to China and Australia.

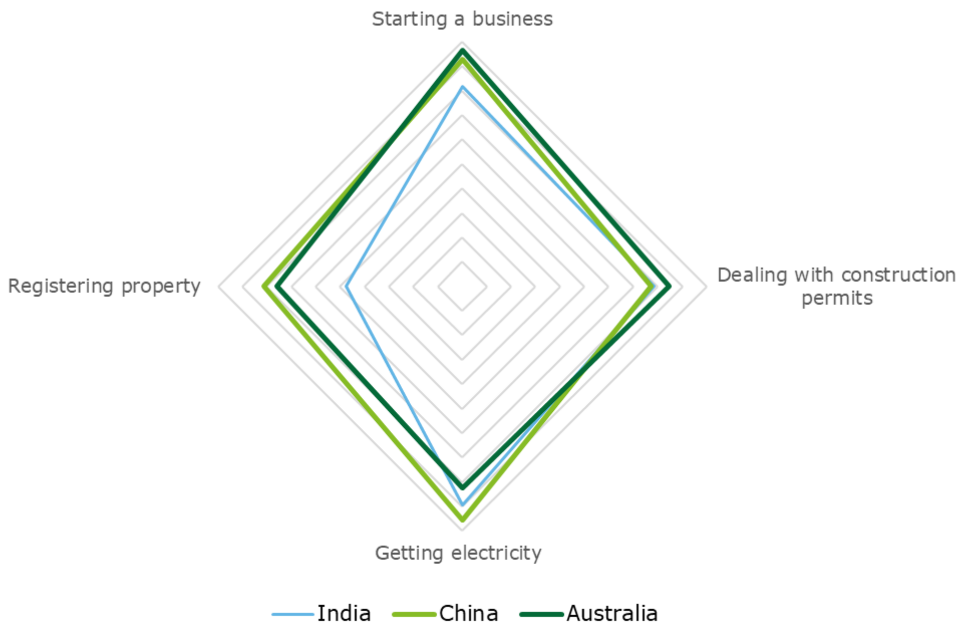
Chart A.22: Indices of labour market regulations, India, China and Australia



Source: ILO

India's regulatory barriers that apply to business development and construction are assessed as broadly similar to that of China and Australia with the exception that it is more difficult to register property. India scored only 48 compared to China (81) and Australia (76) in the World Bank's Doing Business survey (Chart A.23), less than two thirds of the average for China or Australia.

Chart A.23: Indices of construction and business development regulations, India, China and Australia



Source: World Bank (2020).[lxxxi]

A.3.4.2. Regulation of textile wastewater effluent

Wool processing, in particular, wool scouring produces a large volume of wastewater that is highly contaminated. Owing to the high organic and suspended matter concentration of the wastewater, it must be treated and discharged in line with local industrial effluent discharge standards. To this end, the production potential for wool processing countries is dependent on local regulatory conditions with respect to local effluent discharge standards.

Various committees have been constituted in India since 1974 to strengthen regulations around water pollution in India. However, there are no specific environmental laws for the textile sector alone. In 2015, in response to growing pollution concerns the Indian government issued a Draft Notification for Amendment Rules on Standards for Effluent from the Textile Industry (the Draft Notification). The Draft Notification required the textile industry to install wastewater treatment controls and improve the use of water resources. Despite this, textile pollution reductions have not been as extensive as the regulations set out to achieve, restricted by limited monitoring and enforcement activities, as well as slow and low penalties for non-compliance.[lxxxii,lxxxiii]

The standards for effluent discharge from textile industries in India were amended in 2016, owing to increased demand for water for domestic use and below average rainfall in the years leading up to 2014 and 2015.[lxxxiv] Revisions to the regulations were made to introduce more stringent environmental standards for wastewater discharge to reduce water pollution and promote a zero-liquid discharge strategy.[lxxxv] However, there has been limited policing and enforcement of more stringent effluent discharge standards since 2016.[lxxxvi] As a result, effluent discharge in industrial areas continues to be in excess of regulated levels.

Future efforts towards greater enforcement of the existing standards have the potential to cause swift changes to operating environments, creating a highly uncertain and risky production environment for textile manufacturers in India. The effect of this uncertainty was highlighted during consultation with several industry participants describing hesitancy in the Indian industry to invest further in scouring capacity. This in part likely explains the stalled growth in Indian greasy wool imports in recent years with import volumes remaining largely unchanged over the last decade.

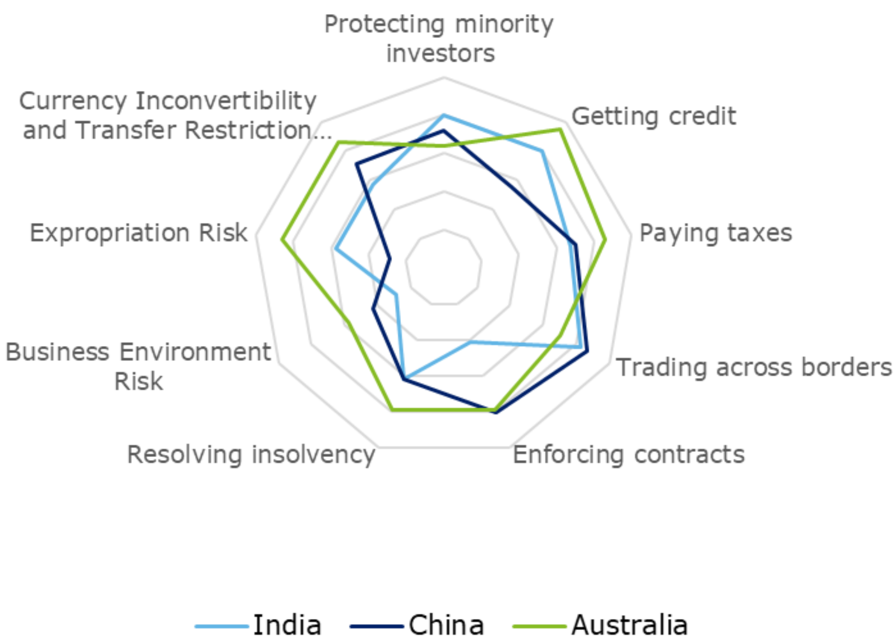
A.3.4.3. Commercial and cultural barriers

When establishing a business in India, it is important to note its size and diversity. There are many regions that differ greatly from one another, making it important for prospective business to focus on key regions and work with a qualified local partner. It is imperative that appropriate legal and taxation advice is sought prior to, and while engaging in, business in India to ensure all contracts, intellectual property issues, and negotiations are considered prior to business commencement. Austrade stresses that businesses wanting to establish a formal market presence in India should be prepared to negotiate and work through legal issues.[lxxxvii] DFAT currently recommends all travellers in India to exercise a high degree of caution due to the high threat of terrorist activity, civil unrest and crime. Furthermore, DFAT stresses Australians must not travel to the Union Territory of Jammu and Kashmir, as well as the India-Pakistan border; while also suggesting that travellers reconsider visiting several other areas.[lxxxviii]

Overall, commercial and cultural barriers for the existing supply chain in India are comparable to China but more challenging than Australia on several fronts. While none identified are assessed as materially significant restrictions, the scores presented in (Chart A.24) highlight where the wool supply chain may face challenges in seeking to diversify via greater integration with India.

Similar to China, India has significantly higher barriers than Australia with regards to currency inconvertibility and transfer restriction, exploration risk, business environment risk and insolvency risk.

Chart A.24: Indices of commercial factors, India



Source: World Bank and Credendo (2022).[lxii]

A.4. Indonesia

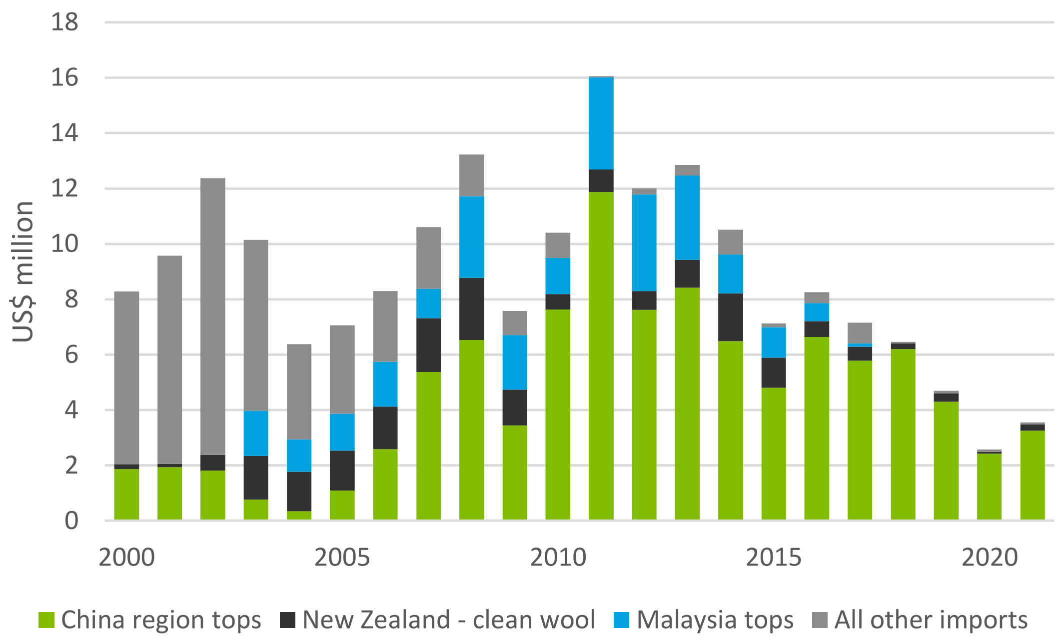
Indonesia is a relatively small market for wool products but as the middle class grows and its integration into global manufacturing increases, the country is positioned to develop into a key market. The strong manufacturing industry for textiles and garments, particularly technical fabrics, is expected to undergo rapid growth as part of a broader expansion of the Indonesian economy. In addition, the Indonesian government has several policies and programs to strengthen and diversify manufacturing, and the local textile industry has expressed interested in processing wool. For this reason, Indonesia is seen as a significant diversification opportunity for the Australian wool supply chain. Australia's free trade agreements with Indonesia also provide low-tariff access for Australian wool, and provides pathways for recourse with respect to excessive NTMs.

A.4.1. Current market for wool

Indonesia is a small market for wool. In 2019 just US$7.0 million was imported and this was around half that achieved just after the global financial crisis (around US$14 million per annum between 2010 and 2013).

This small and declining role of wool in Indonesia is in part explained by reduced tops imports from China which is itself a small component of global wool trade. In the last decade for example, imported tops from China accounts for more than 90% of all Indonesian wool imports. The remaining share of the decline has resulted from reduced tops imports from Malaysia (which ceased in 2017) and modest amounts of clean wool imports from New Zealand. In 2019 Indonesia imported just US$200,000 of NZ clean wool, compared with a peak of US$2.2 million in 2009.

Chart A.25: Indonesia imports of greasy and processed wool



Source: UN Comtrade (2022).

Alongside its modest imports, Indonesian exports of raw or semi-processed wool are negligible. In the 5-years to 2021 Indonesian exports totalled just US$36,000, indicating that which is imported is largely used to service the domestic manufacturing industry.

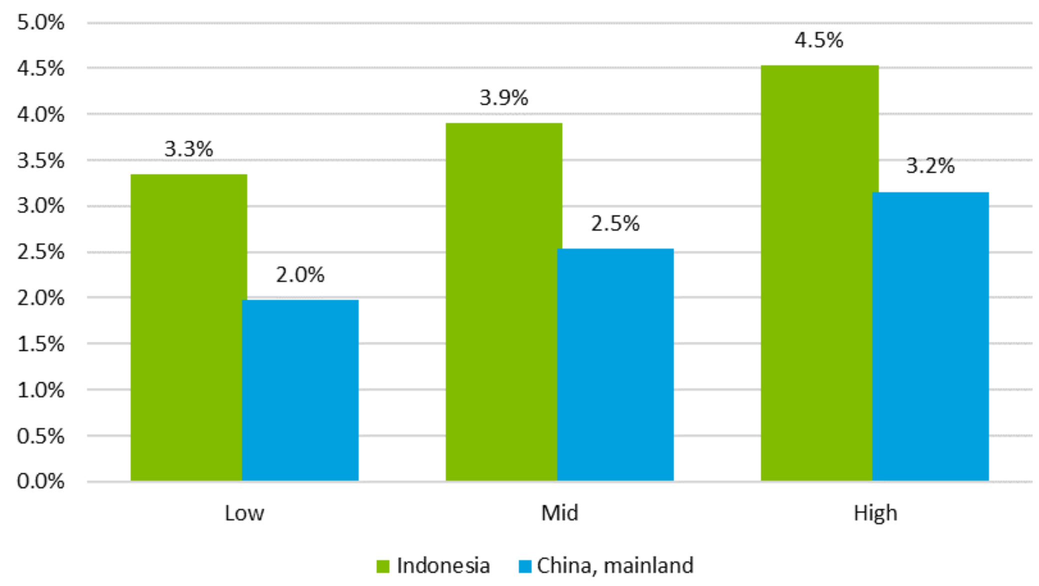
A.4.2. Future textile demand

While wool has a small footprint in Indonesia, the country's manufacturing sector and textile industry are expected to undergo rapid growth in the medium to long term future. Between 2025 and 2050, Indonesia's textile industry is projected to grow strongly at between 3.3% (low scenario) and 4.5% (high scenario) per annum, more than 50% above that projected for the world's largest textile producer, China.

Rapid growth is expected to see Indonesia's share of global textile production expand. This combined with a wool supply chain that services the local textile industry is assessed as not introducing risks from the relocation of customers.

The projected growth in Indonesian textile production underpins optimism within the Australian industry that the market may become a significant market for wool. This is in part reflected in Indonesia's inclusion in a forthcoming Emerging Market Strategy by Australian Wool Innovation (AWI). Moreover, AWI has advised that it has fielded approaches from Indonesia's textile industry, including spinners, who are interested in trialling or integrating wool into existing production systems.

Chart A.26: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

Strong potential future growth in Indonesia's textile industry is supported by recent increases in manufacturing investment. Imports of long stapled spindles for example increased by nearly 90% during the 2010s, although installed capacity remains below levels achieved in the 1990s and currently accounts for less than 1% of the global total.

Much of this anticipated future growth is Indonesia's textile industry is anticipated to be driven by a broader expansion in the Indonesian economy. The Indonesian government has several policies to strengthen and diversify manufacturing within the economy. This includes, for example, the Master Plan of National Industry Development 2015 (MP3EI) which focuses on developing upstream and intermediate industries, and improving the use of industrial technology and the quality of human resources. MP3EI is also supported by the 2018 Making Indonesia 4.0 strategy, which is aimed at expanding the manufacturing sector, raising labour productivity, and using new technology to achieve higher growth through export promotion and "reindustrialization".

These strategies include a range of targets for the manufacturing sector and textile industry, including for the latter to expand to US$75 billion by 2030, and account for 5% of global exports. However, institutions including the WTO have noted this has been a difficult task so far with a range of structural barriers limiting an expansion of manufacturing in Indonesia with the sector's share of GDP falling from around a third to a fifth in the two decades to 2020.

A.4.3. Trade and market access

A.4.3.1. Trade and investment openness

Indonesia has become increasingly integrated in the global economy over the past half century. Despite the country's large domestic economy, the share of GDP accounted for by trade has fallen in recent years. This reflects the rapid expansion in domestic consumption from the rising middle class. In 2019, for example the ratio of trade to GDP was 37.3% down from 48.6% in 2013 and around 60% in 2000.

While open, the Indonesian government has used market access to actively stabilise prices in its domestic market in recent history. Such measures have typically focused on agricultural products, such as cooking and palm oils as well as rice.[lxxxix,xc] Recent price stabilisation efforts have also included active intervention in the textile sector. In May 2022 for example, the Indonesian government introduced tariffs on textile products (until November 2022) in an effort to curtail rising imports of fabric and yarn.[xci]

A.4.3.2. Trade agreements and tariff access

Indonesia has signed and implemented a number of free trade agreements. This includes bilateral agreements with countries such as Japan and Australia, as well as an array of multilateral agreements through the ASEAN free trade region, including with China. Indonesia is also currently negotiating Free Trade agreements with India, Korea and the European Union.

As a result of Australia's free trade access across multiple agreements,[47] applied tariff rates for Australian wool imported into Indonesia are low (Table A.7). This includes greasy and clean wool products, as well as carded and combed wool where zero tariff are faced. China, through its own trade agreement with Indonesia is understood to face similarly low rates.

Table A.7: Indonesia import tariffs for wool products

	Australia	China
Greasy wool	0	0
Scoured wool	0	0
Carbonised wool	0	0
Carded wool	0	0
Combed wool	0	0

Source: DFAT and WTO (2022).

An FTA with South Africa was proposed in 2018 and is currently under consultation. In the absence of such an agreement, MFN tariff rates are applied, putting South Africa at a tariff disadvantage to Australia and China. MNF rates include 5% for greasy wool, as well as carded and combed wool.

Unlike its near neighbours, Vietnam or textile competitor Bangladesh, Indonesia does not have preferential access to major consumer markets in Europe or the United States. While Indonesia does have a free trade agreement with Japan (also a major textile market) the country faces significant tariffs for exports to Europe (on average 10%) and the United States (between 11% and 14% for fabrics of carded or combed wool).

The lack of access to major textile markets has reportedly hampered Indonesian industry growth in recent years. During the COVID-19 affected period of 2020-21, Indonesia's textile industry saw a decline in output, while Vietnam continued to expand. This has seen renewed calls from Indonesian industry to accelerate ongoing discussions with the EU over preferential access. Negotiations for an EU-Indonesia FTA were launched on 18 July 2016 with eleven rounds held to October 2022. As at this time, no trade agreement is being negotiated with the United States.

A.4.3.3. Sanitary issues related to animal disease events

Indonesia is assessed as having uncertain implications for wool trade were Australia to undergo an outbreak of a significant animal disease such as foot and mouth. While the country currently has suffered a recent FMD outbreak, the Indonesian government has historically taken extensive measure to restrict the risk of FMD transmission from imports.[48]

Indonesia has historically placed considerable policy effort into maintaining freedom from animal diseases. This includes FMD, however in May 2022, Indonesia announced that the country was suffering a significant outbreak. As of 16 September 2022 there were 179 active cases with a vaccination program having targeted 2.5 million cattle (around 15-25% of the total).[xcii] The vaccination program has largely been funded and managed by the national government with

[47] This includes the Regional Comprehensive Economic Partnership, the Indonesia-Australia Comprehensive Economic Partnership Agreement and the ASEAN-Australia and New Zealand Free Trade Agreement.
[48] No trade in wool products is recorded between Indonesia and South Africa in 2022 or prior.

support from a range of trading partners, including Australia. It has been accompanied by animal movement restrictions with varying degrees of success.[xciii]

The rapid response to the 2022 FMD outbreak, reflects the long-term caution with which the Indonesian government has historically managed the risk to its large agricultural industry of animal disease. This is demonstrated by Indonesia's long-term restriction on beef[49] imports from countries where FMD is either endemic or prevalent in key regions. In 2016 Indonesia removed a longstanding ban on Indian imports in an effort to actively stabilise prices and diversify supply from Australia, who were the sole supplier. Access was temporarily suspended in May 2021 in part due to perceived risks from the transmission of COVID-19. No changes to import protocols have been announced as of September 2022.[xciv]

A.4.3.4. Other non-tariff measures

A range of non-tariff barriers are understood to exist that impose documentary and resource requirements on exporters of a range of agricultural products.[xcv] Recognised general non-tariff barriers in trading with Indonesia include monitoring and labelling requirements, with complexities and a lack of transparency in the import journey, as well as general trade clearance timeliness.

Indonesia does not impose specific NTMs on wool imports it does however impose multiple NTMs across agricultural goods with a frequency index of 1.0 and a coverage ratio of 1.0. Its prevalence score is however low (at 11.7 NTMs on average for agriculture), as are its indicator scores across manufacturing.

Table A.8: Agriculture and Manufacturing NTM indicators, selected countries.

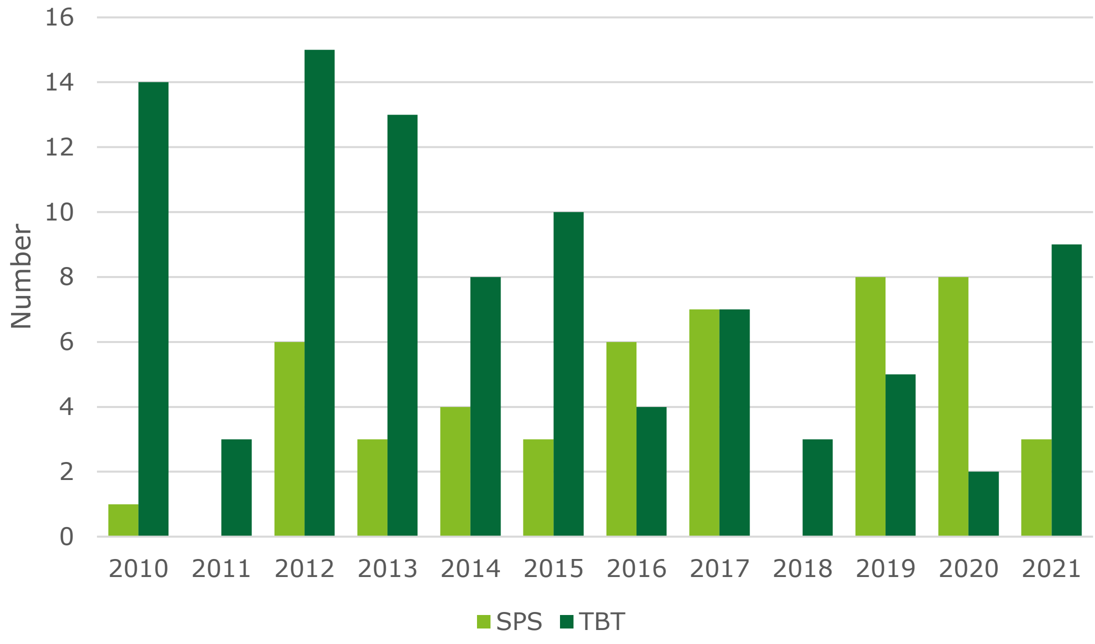
	Indonesia	China	Australia
Agriculture			
Frequency index	1.0	1.0	0.98
Coverage ratio	1.0	1.0	0.98
Prevalence score	11.7	22.8	16.1
Manufacturing			
Frequency index	0.59	0.89	0.63
Coverage ratio	0.60	0.90	0.72
Prevalence score	2.4	5.4	2.1

Source: UNCTAD (2022).[xcvi]

The use of NTMs by Indonesia is relatively modest when compared to developed countries such as the EU or larger inward focussed economies such as China or India. This is consistent with most other developing countries, although while most other countries have observed rising use of NTMs in line with economic growth, the number of NTMs in Indonesia has largely declined in the last decade. This has been driven in part by the country's less widespread use of antidumping measures after 2016. Similarly, Indonesia's use of TBT measures has fallen over time, with 9 measures in force in 2021, down from 14 in 2010.

[49] And other bovine meat

Chart A.27: Number of Indonesian SPS and TBT NTMs in force, 2010 to 2021



Source: WTO (2022).

In contrast SPS measures have become increasingly prevalent in Indonesia, with 8 measures in force in 2020 for example, up from just 2 in 2010. At this level though the number of SPS measures in force remains very low, with the EU for example having around 95 SPS measures in force in 2020.

A.4.4. Other barriers

This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced were Australia's wool industry to engage more strongly with Indonesia. In particular, regulatory barriers are discussed, including labour market regulations and construction and business development regulations, as well as commercial barriers.

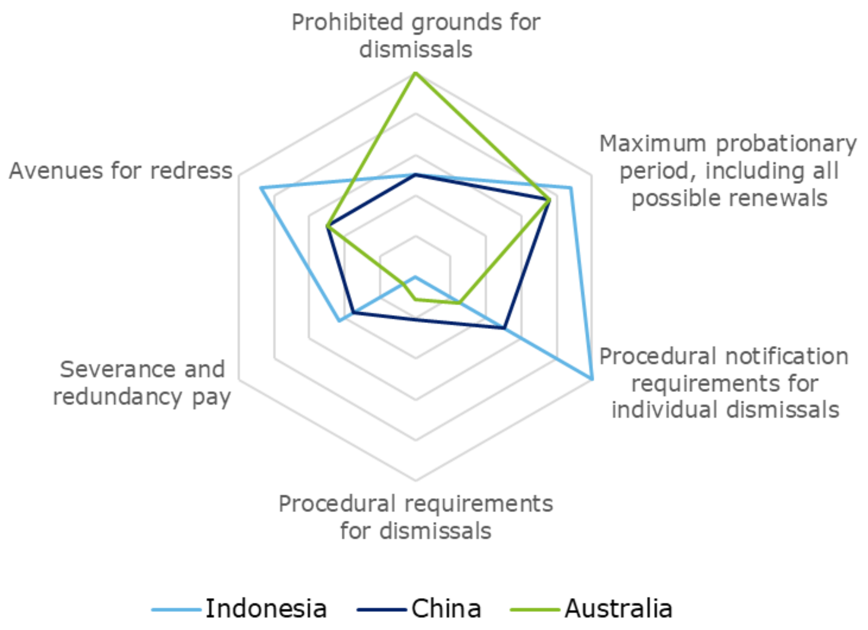
A.4.4.1. Regulatory barriers

Regulatory barriers of particular interest for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues.

The regulatory environment for imports and agricultural commodities, especially finished goods, can be complex, ambiguous and changeable. While there is ongoing discussion around further liberalising investment, several sectors remain fully or partially closed to foreign investment. In addition, rules can constrain the ability of foreign professionals from working in Indonesia.

Indonesia's complex regulatory and legal systems and many jurisdictional layers pose significant barriers to doing business. Strong relationships are critical to success. This is visible in Chart A.28, which shows Indonesia's labour market is more regulated than that of both Australia and China. The exceptions being prohibited grounds for dismissals (in which it is comparable to China but scores lower than Australia), and procedural requirements for dismissals (for which Indonesia scores lower than both Australia and China).

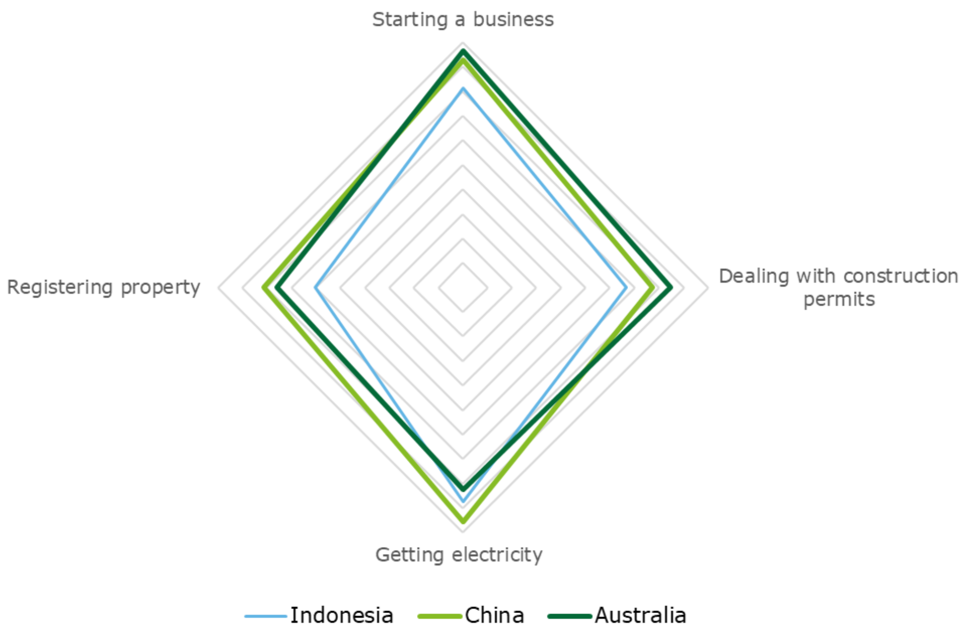
Chart A.28: Indices of labour market regulations, Indonesia, China and Australia



Source: ILO

Indonesia's regulatory barriers that apply to business development and construction are assessed as being slightly higher than that in Australia or China with lower World Bank Doing Business survey scores for ease of registering a property, starting a business and dealing with construction permits. An exception is getting electricity for which Indonesia scores slightly higher than Australia but lower than China (Chart A.29).

Chart A.29: Indices of construction and business development regulations, selected countries



Source: World Bank (2020).[xcvii]

A.4.4.2. Regulation of textile wastewater effluent

Effluent discharge standards in Indonesia are administered under the national Regulation of the Living Environment.[xcviii] Although the national standards for the quality of industrial zone sewage, last updated in 2010, are less stringent than those in India and the European Union.

Local district governments can stipulate higher water quality standards. For example, the West Java province has higher wastewater discharge standards to regulate industrial effluent discharge into the Citarum river.[xcviii] However, there has been a low degree of compliance to these standards, owing to limited government policing and enforcement of effluent discharges from industrial activity.

In a landmark case won by Greenpeace, the Sumedang district government was ordered by the local court to suspend, revoke, and cancel the wastewater discharge permits for three textile factories in Indonesia.[xcix] Although the licenses of three major textile manufacturing factories were suspended in 2014, a study of the water quality in the Citarum River from 2018 indicates that pollution levels continue to be in excess of regulation standards.[c]

While it is likely that national effluent discharge standards will become more stringent in the future to promote sustainable water use in Indonesia, the degree of compliance and enforcement will dictate the level of risk for textile manufacturing. Importantly, consumer behaviour and lobbying from environmental groups has created a relatively uncertain production environmental in Indonesia.

A.4.4.3. Commercial and cultural barriers

Having faced steady growth over the past 10 years, Indonesia has a rapidly expanding middle class which aspires to modern, international standards of living. This has resulted in widespread uptake in smartphone ownership, having been supported by increased access to internet services, enabling digital service use amongst government, businesses and consumers.[ci] As this has emerged, a strong preference for online messaging services, such as WhatsApp, has developed amongst business communities, as well as government, rendering email a relatively unused function that may not be replied to.

There is a strong importance placed on relationship building and peer referrals when establishing new business ventures. As such, the common entry point for Australian businesses is through referral by a local company. Businesses seeking to establish operations in Indonesia must navigate licensing requirements via the Indonesia Investment Coordinating Board (BKPM).

Dispute resolution in Indonesian civil proceedings follows the Dutch Civil law tradition of three court levels that will take approximately three years, in order – District Court, High Court and Supreme Court. Given the relative ease of engaging with the legal system, cases will often graduate to each level of court proceedings – losing parties will appeal decisions and apply for an annulment at the Supreme Court in most commercial disputes. There is serious concern among Indonesian and International NGOs around the levels of corruption within the Indonesian system, with several prominent judges investigated in recent years by the Corruption Eradication Commission (KPK). As a result, it has been increasingly common for international companies contracting with Indonesian entities to include provisions for dispute resolution to be undertaken in foreign jurisdictions.[ci]

Domestic economic policy post COVID-19 has focused on the development and expansion of manufacturing. Reactionary trade policies have increased the complexity of doing business and prompted structural reforms (e.g. the passing of Omnibus laws). These reforms aim to improve the ease of doing business and increase foreign direct investment. The government has also established specialised economic zones, whose key focus is to increase the amount of targeted foreign investment into Indonesia. The country's large consumer economy has spurred consumer protections, notably protections and traceability of products. State owned enterprises are still active in the economy, namely utilities, which can be both enablers and detractors of investment into specific sectors.

Selected indicators that quantify some of the above challenges for companies considering doing business in Indonesia are illustrated in (Chart A.30). Indonesia scores lower than Australia but similar to China on most indicators. Notable expectations being enforcing contracts and trading across borders where Indonesia scores significantly lower than both Australia and China.

Chart A.30: Indices of commercial factors, Indonesia

Source: World Bank and Credendo (2022).[lxii]

A.5. Republic of Korea

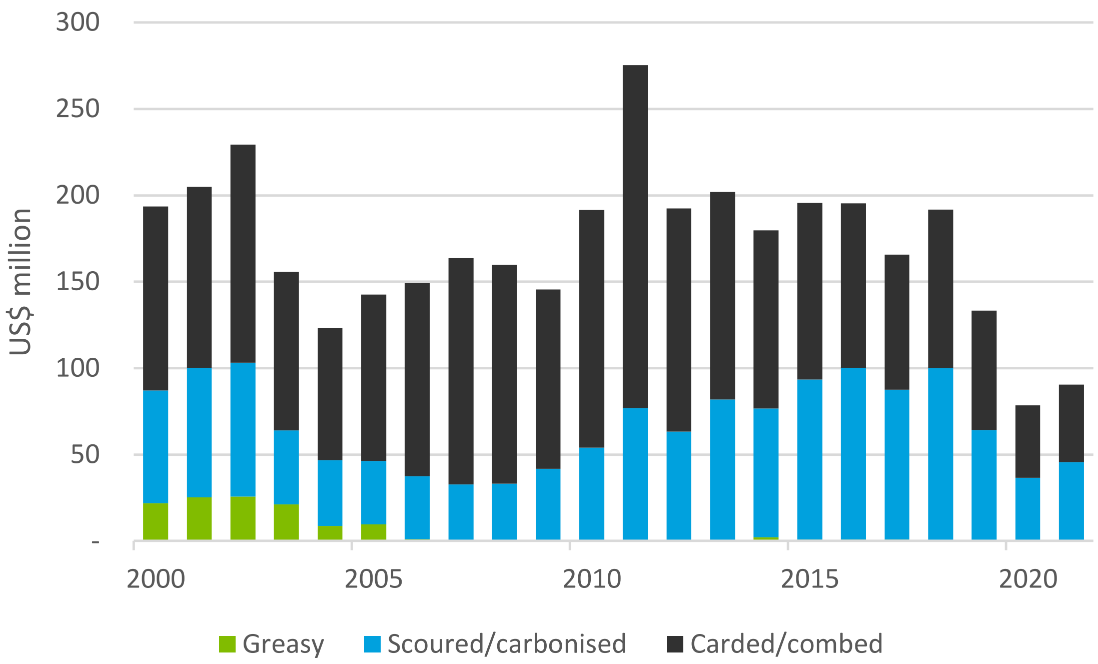
Korea is an established and advanced global manufacturing centre and an important market in the global wool trade. Its processing capacity is dominated by established players, with recent increases in the importation of clean wool to support textile manufacturing. Currently Australia is a key supplier of carbonised wool into the country. Despite these conditions, Korea is not a priority market for the Australian wool industry. With an established domestic economy, and significant structural change expected in the textile industry in the short to medium term, the market for wool is not expected to significantly grow. More broadly, the Korean textile industry has a declining footprint within its manufacturing sector, and the Korean economy is expected to face headwinds related to its aging and declining workforce.

A.5.1. Current market for wool

The Republic of Korea is an important market for the global wool trade. In 2020 the market had 5% share of the global installed capacity of long-staple spindles, the fourth largest in the world. While Korea doesn't import greasy wool in any significant quantity it has a long-term history of processed wool imports. The total value of Korean imports has not varied greatly since 2000, with imports averaging US$200 million per annum during this period.

Korean imports are split relatively evenly between clean wool and wool tops, although the share of clean wool has been rising over time. In the three years to 2021 clean wool accounted for around half of imports, compared with being a third of imports a decade ago.

Chart A.31: Wool imports by product, Korea

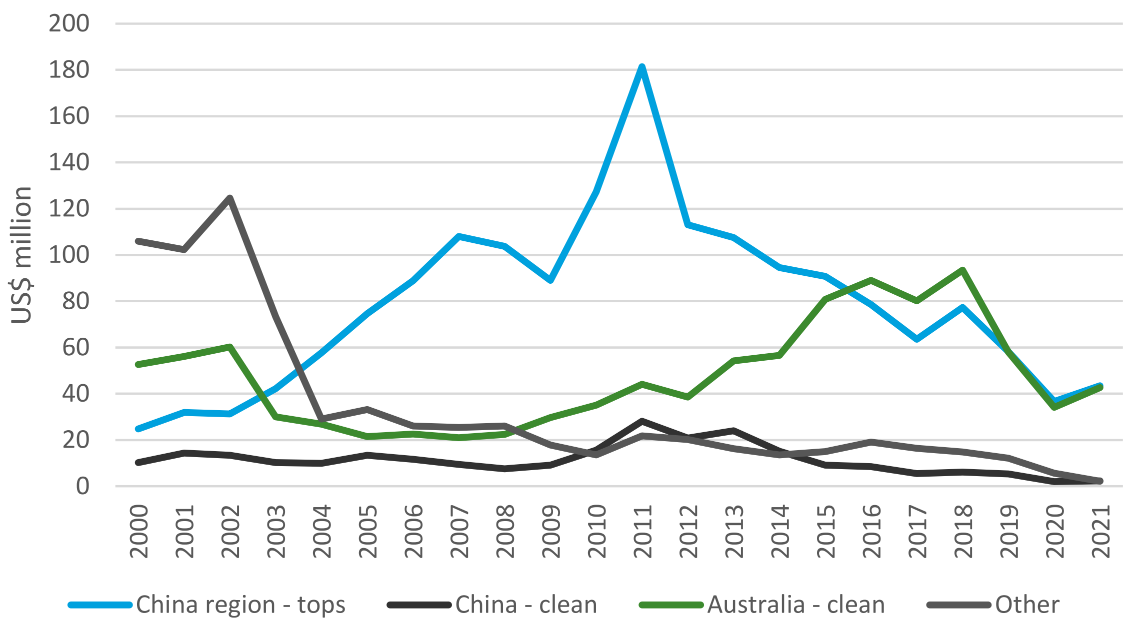


Source: UN Comtrade (2022).

The growing share of clean wool is in part a result of declining imports of tops. In 2010 wool top imports from China accounted for two thirds of all imports, with trade valued at around US$127 million. Since then, this trade has effectively halved, with Korea importing just US$58 million in tops from China in 2018.

In place of tops, the Korean textile industry has shifted further up the processing supply chain to import more clean wool. However, very little of this is from China, from which imports are moderate (at around US$6 million per annum) and declining (6% lower in 2018 than in 2010). Rather, the increase in imports has been predominantly from Australia and has consisted almost wholly of 20 µm to 23 µm carbonised wool. Between 2005 and 2018, Australian clean wool exports to Korea saw largely uninterrupted growth, with trade increasing 5-fold from around US$20 million to US$100 million. Consultation with industry advised that most of this trade reflects substantial commercial relationships with a selected number of dry combing processors in Korea.

Chart A.32: Korean wool imports by product and supplier



Source: UN Comtrade (2022).

Korea exports a modest amount of raw and early stage processed wool, particularly when compared to imports. In the 5-years to 2021, exports averaged $1.1 million per annum, less than 1% of the value of imports during this period.

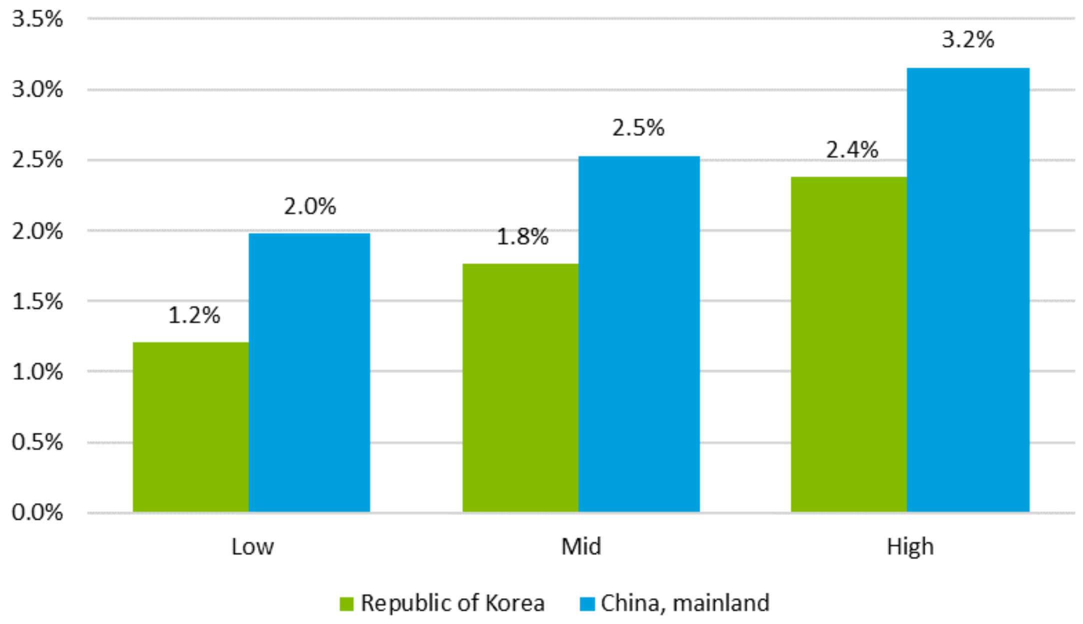
A.5.2. Future textile demand

While Korea is a centrally important market for Australia's processing sector, strong future growth is not anticipated. This is in part due to the long-term decline in capacity investment with long-stable spindle imports being negligible since 2011. Future prospects for textile demand also reflect projected slow long term industry growth, with Korean textile value added projected to expand at between 1.2% and 2.4% between 2025 and 2050. This is around 60% of that projected for the world's largest textile industry, China, and is expected to result in Korea's share of global textile manufacturing fall from its current small footprint (of around 1.4% in 2020).

Future slow growth in Korean textiles reflects in part an expected general slowdown in the Korean economy. Out to 2050, the Korean economy is anticipated to face growth headwinds particularly related to its aging and declining workforce. Future growth is also expected to reflect the declining footprint in Korean textiles industries within manufacturing over time. This potential growth pathway is assessed as a moderate risk of geographic shifts in demand with slowing growth having the potential to drive consolidation and firm exit of spinners and other customers.

Advice provided during consultation indicated that Korea's textile industry is currently operated by a handful of longstanding organisations that are likely to experience ownership changes in the short to medium term. This is expected to result in significant structural adjustment. To some extent these trends have been underway for recent decades. Manufacturing, for example, has remained a central part of the Korean economy, accounting for around 25% of GDP since the 1990s. This reflects its global digital importance and integration into global value chains; however textiles have steadily shrunk. In 2019, textiles and clothing accounted for just 3% of manufacturing value added, down from 13% in 1990.

Chart A.33: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

A range of strategy and policies exist to support Korea's manufacturing sector in the long term. However these focus on the competitiveness of digital and other advanced manufacturing industries. The Korean New Deal Initiative for example aims to enhance the competitiveness of the manufacturing sector by increasing public investment in digital and green energy infrastructure.

A.5.3. Trade and market access

A.5.3.1. Trade and investment openness

Since the 1970s, Korea has developed as a centre for high tech manufacturing and has created a large domestic consumer economy. Korea is an active participant in global trade organisations, such as the WTO and OECD. The country is a key political and economic player in East Asia. Its history and relative proximity to other large economies in the region, such as Japan and China, have seen its trade focus on high technology manufacturing.

Korea is a major global exporter and is heavily integrated into global value chains. Korea's openness to international trade and its integration into the world economy continued to be reflected by the high ratio of its trade (exports plus imports) in goods and services to GDP, which stood at 69.2% in 2020, though lower than in 2016.

Its main exports are dominated by merchandise including electrical and electronic equipment (31% of total 2021 exports), machinery, nuclear reactors and boilers (13%) and vehicles (11%). Its biggest imports include electrical machinery and parts and machinery (20%), mineral fuels (19%), and nuclear reactors and boilers (12%).

A.5.3.2. Trade agreements and tariff access

As an active player in global trade, Korea has developed and ratified many bilateral free trade agreements. As at September 2022 Korea had signed and entered into force FTAs with 52 countries, providing a trade coverage equivalent to 70% of the global economy. Countries with which Korea has FTAs includes the European Union, the United States, Australia and China.

As Korea has FTAs with most major consumer markets, it has preferential access for its textile product exports. It is unlikely that any further improved access for Korea could be achieved, and particularly in the context of the EU, where Korea's tariff advantage in exporting textile products has been steadily eroded by improved access for other Asian countries.

Under Australia's FTA with Korea, Australian wool face applied tariffs of 0% across greasy, clean, carded and combed products. Similar rates are faced by China and South Africa, who also has an FTA with Korea. As a result, Australia has no preferential advantage in exporting wool to Korea (Table A.9).

Table A.9: Korea import tariffs for wool products

	Australia	China
Greasy wool	0	0
Scoured wool	0	0
Carbonised wool	0	0
Carded wool	0	0
Combed wool	0	0

Source: DFAT and WTO (2022).

A.5.3.3. Sanitary issues related to animal disease events

Korea is assessed as having limited risk implications for wool trade were Australia to undergo an outbreak of a significant animal disease such as foot and mouth. This is because Australia's trade in wool with Korea is predominantly carbonised wool, which undergoes scouring consistent with OIE guidelines (*"industrial scouring which consists of the immersion in a water-soluble detergent held at 60-70°C"*).

Australia's free trade agreement with Korea covers non-tariff measures (Article 2.10). According to the agreement, *"the Parties recognise the importance of ensuring the transparency of non-tariff measures affecting trade between the Parties and that any such measures should not create an unnecessary obstacle to trade between the Parties"*. The agreement also provides avenues for recourse, including review and resolution procedures for specific non-tariff measures.

Korea has a relatively recent history of animal disease issues, including several FMD outbreaks occurring in the last decade. In 2000, 2002, and most recently in 2010-11, outbreaks of FMD required control methods by the government that included the disposal of approximately 12% of the country's livestock.

Korea has historically introduced strict restrictions on imports from countries that have animal diseases such as FMD. This includes, for example, prohibitions announced by the Minister of Agriculture and Forestry, with Article 21 of the Act on the Prevention of Contagious Animal Diseases outlining the power to prohibit imports of animals and carcasses, as well as animal products (such as bones, flesh, skin, eggs, hair, hooves and horns). Such import controls are demonstrated through Korea's ban on US beef imports in 2003 after a reported outbreak of bovine spongiform encephalopathy. Trade was restored in 2008, and in 2020 beef imports were valued at around $2.5 billion.[50]

A.5.3.4. Other non-tariff measures

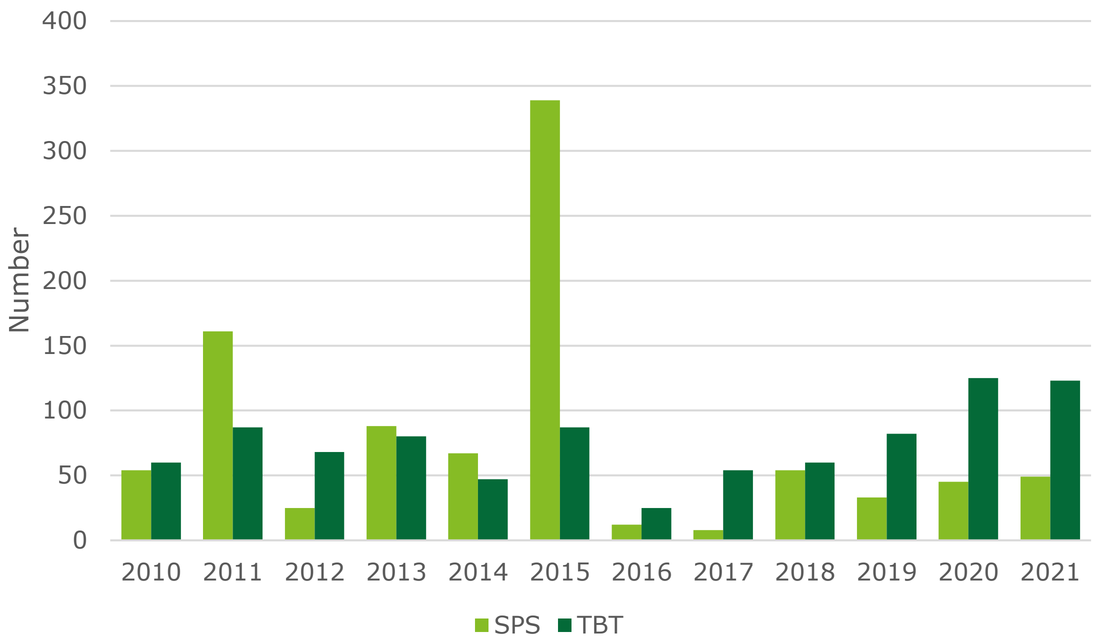
There are no specific non-tariff measures applied to imported wool. However, consultation with overseas postings advised that key barriers include border inspections that are understood to be strict. There are reports that some products receive stricter inspections since Korea joined the CPTPP. Documentation issues are also understood to be of particular relevance for Korea customs progression and any issue is likely to lead to shipments being rejected at the port.

The use of NTMs by Korea is moderate[51], sitting below that of developed countries of the EU or China, but usage is well above that employed by developing nations. Most Korean NTMs are

[50] No trade in wool products is recorded between Korea and South Africa in 2022 or prior.
[51] No data is available on the country's NTM frequency index, coverage ratio or prevalence scores for agricultural or manufactured goods.

sanitary and phytosanitary controls and technical barriers to trade. Growth in NTMs has largely been driven by technical barriers, which have effectively doubled since 2010.

Chart A.34: Number of Korean SPS and TBT NTMs in force, 2010 to 2021



Source: WTO (2022).

A.5.4. Other barriers

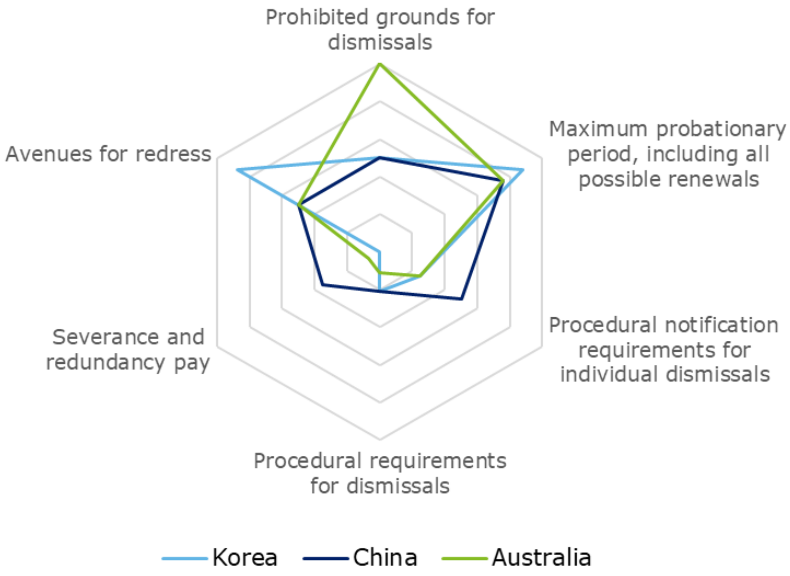
This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced were Australia's wool industry to engage more strongly with the Republic of Korea. In particular, regulatory barriers are discussed, including labour market regulations, construction and business development regulations, and regulation of wastewater effluent, as well as commercial barriers.

A.5.4.1. Regulatory barriers

Regulatory barriers of particular importance for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators were selected to analyse the performance of shortlisted locations across these issues.

For labour market regulations (Chart A.35), Korea compares favourably to China or Australia across most indicators. Korea has similar severance and redundancy pay and procedural notification requirements for individual dismissals to Australia (less than China). Similar prohibited grounds for dismissals and procedural requirements for dismissals to China and more regulation of avenues for redress and maximum probationary periods than either China or Australia.

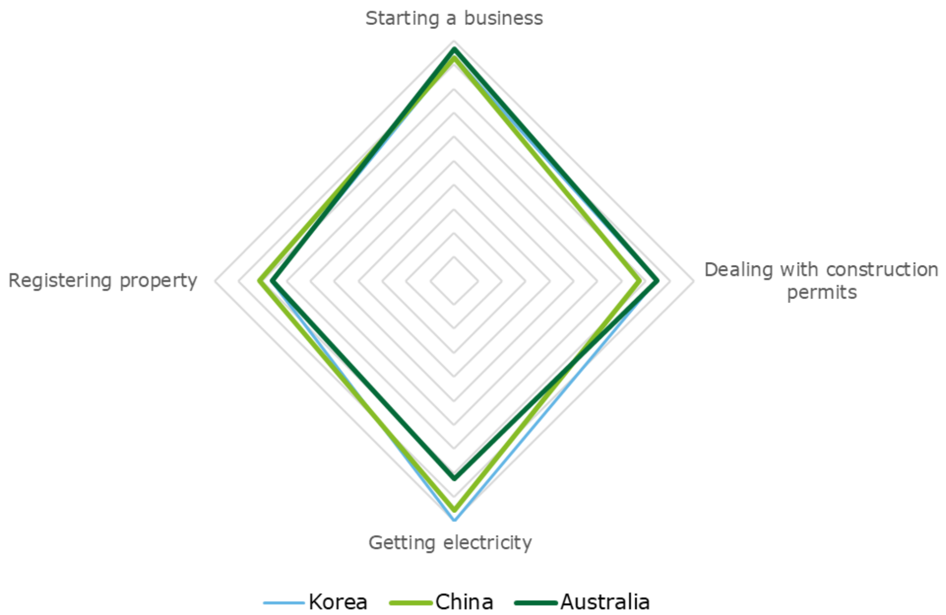
Chart A.35: Indices of labour market regulations, Republic of Korea, China and Australia



Source: ILO

The Republic of Korea's regulatory barriers that apply to business development and construction are assessed as broadly similar to that of China and Australia according to the World Bank's Doing Business survey (Chart A.36).

Chart A.36: Indices of construction and business development regulations, Republic of Korea, China and Australia



Source: World Bank (2020).[cii]

A.5.4.2. Commercial and cultural barriers

It is imperative that Australian industry representatives are aware of the strong sense of culture and respect for hierarchy that is embedded in Korean business practices. Formal introductions are very important, with weight placed on the social standing of those facilitating introductions. Given the hierarchical nature of business, introductions and business cards must clearly identify distinctive roles, as well as the company being represented. Ongoing relationship building is key and is often done through informal social gatherings or business dinners. While relationship building is important, improper solicitations of public officials or the offer of, or acceptance by, public officials of anything of value is prohibited under the Improper Solicitation and Graft Act, more commonly known as the 'Kim Young-Ran Act'.[ciii]

Commercial practices to consider are certificates required for products. To qualify for preferential tariff treatment under the Korean-Australia Free Trade Agreement (KAFTA), goods require a Certificate of Origin (COO) subject to certain exceptions.[civ] Commercial practices in Korea are typically covered by insurance. Where a Cost, Insurance and Freight (CIF) contract is in place, the policy must cover 110 per cent of the invoice value, be endorsed by the exporters and expressly state that claims are payable in the currency of the draft.[civ] Korea allows for foreign direct investment into many industries, notably manufacturing. Though this investment is still lower than other OECD nations.[cv]

Korea operates nine Free Economic Zones across the country. These regions seek to attract foreign business using tax benefits and reduced regulations. Incentives include tax breaks, cash grants, infrastructure support and relief from labour regulations. In 2021, cumulative FDI passed $20 billion, with manufacturing the biggest investment recipient. This was mostly concentrated in pharmaceuticals and metals production.

Selected indicators that quantify the cultural and commercial challenges of doing business in Korea are illustrated in (Chart A.37). Korea's scores are broadly similar to Australia's on most indicators and significantly better than China's. The exceptions are that it is more difficult to get credit in Korea than in Australia (but still easier than China), and Korea has more protections for minority investors than both China and Australia.

Chart A.37: Indices of commercial factors, Republic of Korea

Source: World Bank and Credendo (2022).[lxii]

A.6. Türkiye

Türkiye is a key global textile manufacturing centre. The country's proximity to, and trade relationship with, the EU positions it as a key manufacturing hub for the block. Türkiye's textile industry is largely centred on cotton processing, and while it maintains a large wool processing capacity this is focused on greasy wool imports from near neighbours such as Romania. Türkiye's textile industry is expected to expand strongly in the future, although considerable growth risks have emerged in recent years. These challenges have translated to significant commercial barriers and an uncertain outlook for manufacturing more broadly in Türkiye. As a result the country is assessed as being a moderate opportunity to diversify Australia's wool supply chain, and mainly focused on greasy exports.

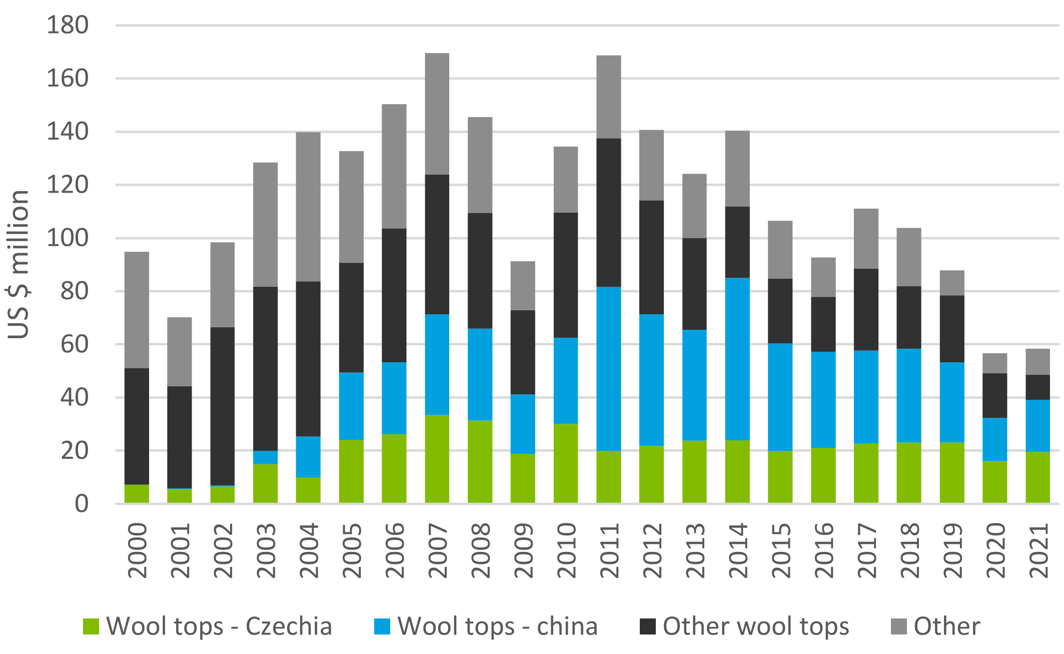
A.6.1. Current market for wool

While much of Türkiye's textile industry is centred on cotton, the country has a relatively large wool processing capacity. This is reflected in its estimated installed capacity of long staple spindles which at 2020 was ranked third globally and accounted for around 6.0% of the global total.

In 2021 Türkiye imported around US$60 million in greasy and processed wool. This was the smallest value since 1990 and was partly affected by COVID-19. Prior to this, imports had largely been in steady decline, with the value of trade in 2018 (around US$125 million) approximately 30% below that achieved before the Global Financial Crisis in 2008.

In the early 2000s, Türkiye's wool imports were split relatively evenly across greasy, clean and wool tops. Previously dominated by greasy wool, Türkiye's wool import mix has become increasingly based on carded and combed wool. Reflecting this, China, Czechia and Italy are among the largest suppliers, as well as Argentina. Collectively wool tops from these four suppliers accounted for 88.5% of all wool imports in the three years to 2021.

Chart A.38: Türkiye wool imports



Source: UN Comtrade (2022).

Australia mostly exports only clean wool to Türkiye and this predominantly consists of 20 μm to 23 μm (30% of import quantity in the three years to 2021) and 19 μm and finer (61%). Clean wool imports are a small and shrinking aspect of trade for Türkiye. In the three years to 2021, an average of US$6.1 million was imported compared with a trade value of around $22 million in 2000. During this period, Australia and New Zealand have been the main suppliers, collectively accounting for 73% of clean imports during this period. China as a significant supplier of scoured wool globally, accounted for less than 1.0% of Türkiye's wool imports.

Türkiye's greasy wool imports are almost solely supplied by Romania and a selection of other Eastern European countries. This trade is assumed to consist of relatively broader gauge wools, with import unit values averaging around US 38 cents a kilogram in the three years to 2021. This compares with Australian greasy wool imports that range between US$7 and US$11 a kilogram since 2011.

Much of Türkiye's greasy imports, while small in volume and value, appear to be exported after being cleaned. The primary destinations for wool cleaned in Türkiye are China, India and the United Kingdom. Exports more broadly are significant in the context of imports. In the 5-years to 2021, Türkiye exported US$34.1 million in raw or semi-processed wool a year, around a third of the imported value during this period. While shifting global demand from spinners and other customers may pose as a modest risk for Türkiye, its close proximity to the EU market is assessed as a significant opportunity particularly for supply chains looking to near-shore activities.

Chart A.39: Türkiye greasy wool imports and clean exports

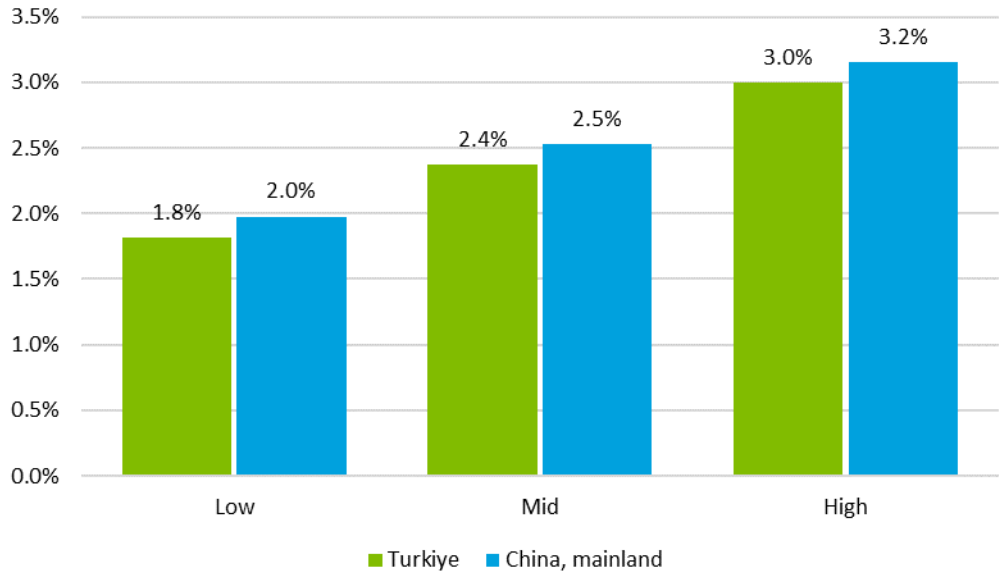
Source: UN Comtrade (2022).

A.6.2. Future textile demand

Türkiye's low-cost base and proximity to major consumer markets (both relative to Europe), as well as its strategic connectedness to logistics networks, make it an attractive prospect for manufacturing industries. Despite this, longer-term growth textile industry demand in Türkiye's is uncertain amidst slowing growth, broader economic uncertainty and a transitioning economy.

Between 2025 and 2050 for example the Turkish textile industry is projected to grow modestly at between 1.8% and 3.0% per annum. This mid-range growth is expected to see Türkiye maintain its share of global textile manufacturing at around 3.7% and is moderately softer than the rate of growth projected for the largest textile manufacturer in the world, China (between 2.0% and 3.2% per annum).

Chart A.40: Projected textile industry growth rates, average between 2025 and 2050



Source: Deloitte Access Economics (2022).

Much of the future growth in Turkish manufacturing is anticipated to be underpinned by broader economic growth. In recent years Türkiye's economy has grown steadily, albeit at an incrementally slower rate as high inflation, debt and unemployment created broader headwinds. In 2011 for example, GDP growth was estimated at 11%, compared with just 3% in 2018.

The uncertainty over Türkiye's textile industry also reflects broader structural changes in the Turkish economy. At present, Türkiye's manufacturing sector is focused on textiles and clothing, (which accounts for 16.5% of manufacturing value added). Unlike most other countries, shipments of spindles have remained relatively steady since the 1990s, suggesting continued intent to expand productive capacity. However, the manufacturing footprint in Türkiye has fluctuated wildly in recent decades reflecting a range of policy and economic challenges. In 1990 the sector accounted for 22% of GDP, a share which fell to around 10% in 2010, but since recovered to 22% by 2020.

Manufacturing is likely to remain a key part of Türkiye's economy given its comparative advantages and broad policy support for the sector. However, textiles are anticipated to be an increasingly diminished part of the sector as Türkiye pursues growth in digital and technologically advanced industries. Turkish policies in support of this transition include the 2023 Industry and Technology Strategy (which details incentives for research, development and digital transformation of industrial enterprises and focusses on technologies from block chain to robotics); the regularly updated Development Plans, with the tenth iteration (the Input Supply Strategy, and Türkiye Vision 2023) setting out multiple objectives for manufacturing, including increasing production of intermediate and finished goods to reduce the trade deficit among other goals; and the Turquality Scheme, which aims to implement advanced branding of Turkish products as high quality.[cvi,cvii]

A.6.3. Trade and market access

A.6.3.1. Trade and investment openness

Türkiye is a globally engaged country with active involvement in a range of organisations including the G20, the Organisation for Economic Co-operation and Development (OECD), and the World Trade Organization (WTO).

Türkiye has become an increasingly open economy although its increased orientation to trade has largely focussed on the European Union. In 2021 trade's share of Türkiye's GDP was 35.4%, up from around 20% in 2000. Türkiye is the EU's 6th largest trading partner, while the EU is overwhelmingly Türkiye's dominant partner. In 2020, 33.4% of Türkiye's imports were from the EU and 41.3% of the country's exports were to the European Union.[cviii]

A.6.3.2. Trade agreements and tariff access

EU-Türkiye trade relations are underpinned by a Customs Union agreement, which entered into force on 31 December 1995 (as well as a 1963 Association Agreement). Since 1999 Türkiye has been a candidate country to join the European Union, however after commencing in 2005 negotiations have not advanced in recent years.[cviii]

The Customs Union covers all industrial goods, including processed agricultural products.[52] It allows for free movement between the two parties for covered goods which are either wholly produced or put in free circulation after their importation from third countries into either Türkiye or the EC. The Customs Union also provides for a common external tariff for the covered products and requires that Türkiye aligns to EU law in areas related to the Customs Union, most notably customs legislation, technical barriers to trade, and intellectual property.

In addition to the Customs Union, Türkiye has 22 Free Trade Agreements in force. This mostly includes other European nations (i.e. the EFTA countries, North Macedonia, Albania and the United Kingdom) as well as strategic middle eastern and north African near-neighbours, such as Israel, Tunisia, Morocco, and Egypt. Outside of these regions, Türkiye has selected agreements with high export orientated Asian economies of South Korea, Malaysia and Singapore. Alongside its ongoing negotiations for EU ascension, current negotiations include agreements with Japan and Pakistan.

Türkiye, like the EU maintains relatively low applied tariffs on imports of wool products. As neither Australia nor China have preferential access, MFN rates apply. For both suppliers, tariffs applied to greasy and clean wool are set to zero. A tariff of 2% is applied to carded or combed wool (Table A.10).

Table A.10: Türkiye import tariffs for wool products

	Australia	China
Greasy wool	0	0
Scoured wool	0	0
Carbonised wool	0	0
Carded wool	2	2
Combed wool	2	2

Source: World Bank (2022).[cix]

Half of Türkiye's tariff schedules are unbound, having the potential for subjective increases. Tariffs on agricultural lines are capped at 100%. Demonstrating the potential for increases, Türkiye temporarily raised effective tariff rates on 5,088 (of 16,437) Customs Tariff Statistics Positions (GTIP) product codes with 6 different Presidential decrees in the second quarter of 2020. The rates were to be removed by October 2020 but a subsequent Presidential decree in September extended their life to December 2020. FTA partner countries were exempt from the tariff increases, and increases were not applied consistently across commodities or partners. Imports of cotton (1.2%), wool (0.3%), fabric (2.1%) and apparel (up to 3.2%) were all affected.

A.6.3.3. Sanitary issues related to animal disease events

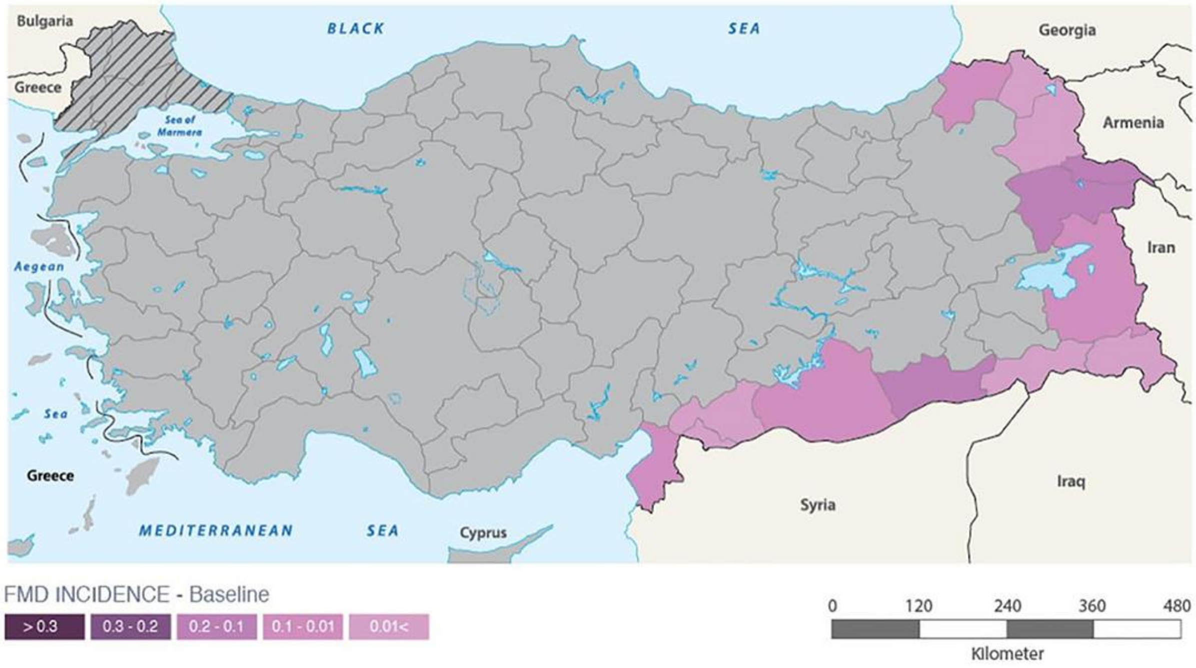
Türkiye is assessed as having uncertain risk to loss of market access if Australia were to suffer a significant animal disease event, such as foot and mouth. This is mainly because animal disease issues are widespread in Türkiye and government control programs have made little progress in managing ongoing risk of outbreaks.

[52] It does not address agriculture, services or public procurement.

In Türkiye, animal disease issues are widespread, with FMD being endemic in parts of eastern Türkiye. In this region, bordering eastern and southern neighbours are also subject to ongoing animal disease issues and animal border crossings have limited regulation and illegal crossings are common.

While endemic, the Turkish government aims to achieve an OIE status of being FMD-free with vaccination by 2023. In pursuit of this goal, FMD prevalence was reduced to around 5% in 2018 as a result of the government's vaccination and surveillance programs. Despite this progress, many of Türkiye's near neighbours are FMD-endemic and large-scale illegal cross-border movements are likely to remain a significant threat to Türkiye's FMD prevalence in the future.[cx]

Figure A.2 Foot and mouth prevalence in Türkiye's border regions



Source: Ozturk, Kocak and Ahmadi (2020).

Note: Grey area denotes the Anatolia region of Türkiye, hashed lines describe the Thrace region which has been declared FMD free.

No trade with South Africa before or after the country's 2022 FMD outbreak has been identified. As Australia does not have a trade agreement with the country, no avenues for recourse are established in the face of NTMs that could be deemed to be exceeding the internationally agreed principals developed by the OIE.

A.6.3.4. Other non-tariff measures

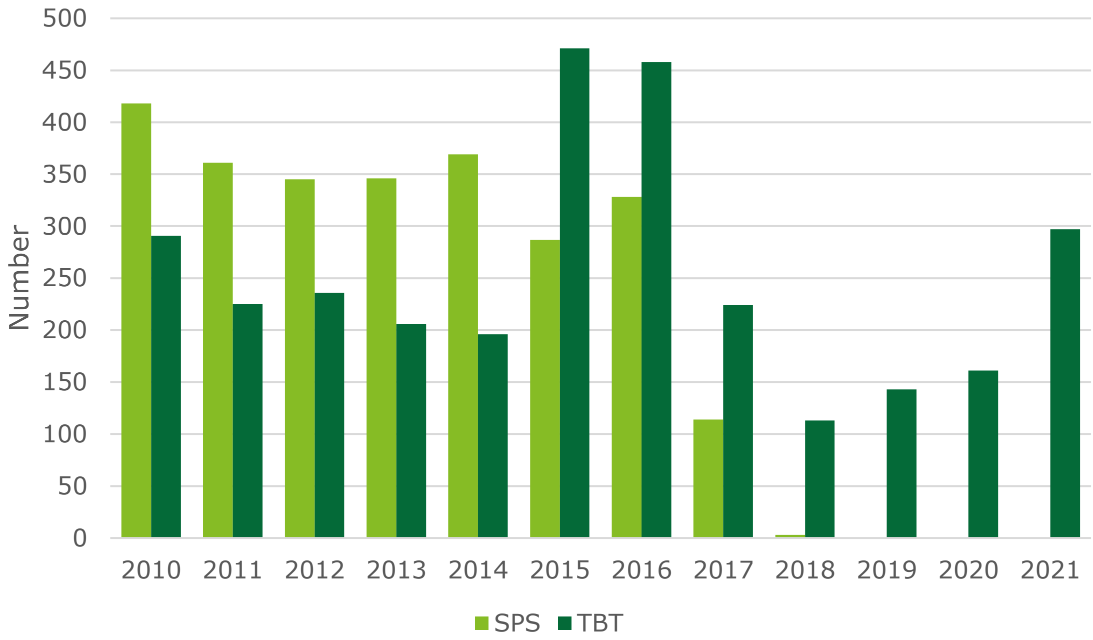
Imports and exports from Türkiye can be subject to several non-tariff measures. For wool products specifically, specific processes for the importation, certification and monitoring of imports are done. Türkiye uses many anti-dumping measures to protect its domestic market, with over 180 enforced measures limiting dumping. In 2018 the largest number of measures were introduced, with 35 centred around the classification and labelling of machinery products.

There is no specific NTM for Australian imports, with most wool imports into the country subject to the same NTMs that are also applied to textile, leather, and cotton products. The certification of Turkish imports is in line with the EU's common external tariff (CET), equalising tariffs between the two markets.

Türkiye adheres to many agreements on the control of strategic goods, and it conducts quality control checks on agricultural exports. These controls apply to many goods for import and export, including untreated and processed wool products. Certification is potentially required for importation, with Türkiye's Department of Trade and Ministry of Agriculture able to inspect and monitor all imports of animal products. These certification and monitoring practices are aligned to those of many EU nations, implying some alignment with Türkiye's non-tariff measures and those of the EU. As trade between the EU and Türkiye increases, processes and certification will likely become more aligned, with the potential for Türkiye to act as a processing centre and entry point for Australian top and scoured wool to enter garment markets in the EU.

Türkiye's proximity to the leading sustainable markets of the EU and the UK could also influence the long-term requirements for the certification of imports. The release of circular economy frameworks in the EU and the UK will influence consumer and manufacturing expectations regarding traceability, emissions, and the overall impact of production. As a key manufacturing centre, and close trading partner Türkiye could be required to adapt its requirements for importation. Australian wool products could be required to improve traceability and monitoring for access to the market. It could also present an opportunity for Australian wool producers to differentiate its products as sustainable and ethical.[cxi]

Chart A.41: Number of Turkish SPS and TBT NTMs in force, 2010 to 2021



Source: WTO

A.6.4. Other barriers

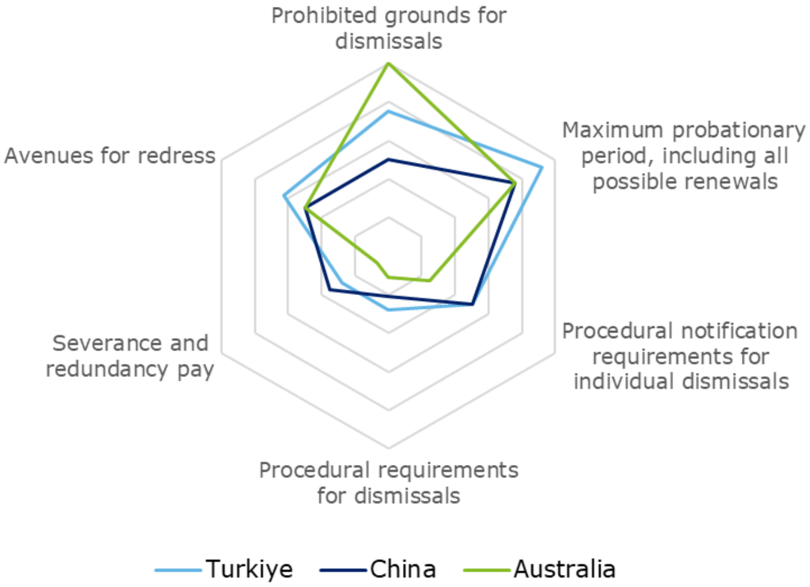
This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced if Australia's wool industry were to engage more strongly with Türkiye. In particular, regulatory barriers are discussed, including labour market regulations and construction and business development regulations, as well as commercial barriers.

A.6.4.1. Regulatory barriers

Regulatory barriers of particular importance for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues.

For labour market regulations (Chart A.42), Türkiye compares favourably to Australia and China, scoring about equal or higher than both on most indicators. Türkiye also scores higher than China and Australia on avenues for redress and maximum probationary periods. However, on prohibited grounds for dismissals, Türkiye's score sits halfway between that of Australia (highest) and China (lowest).

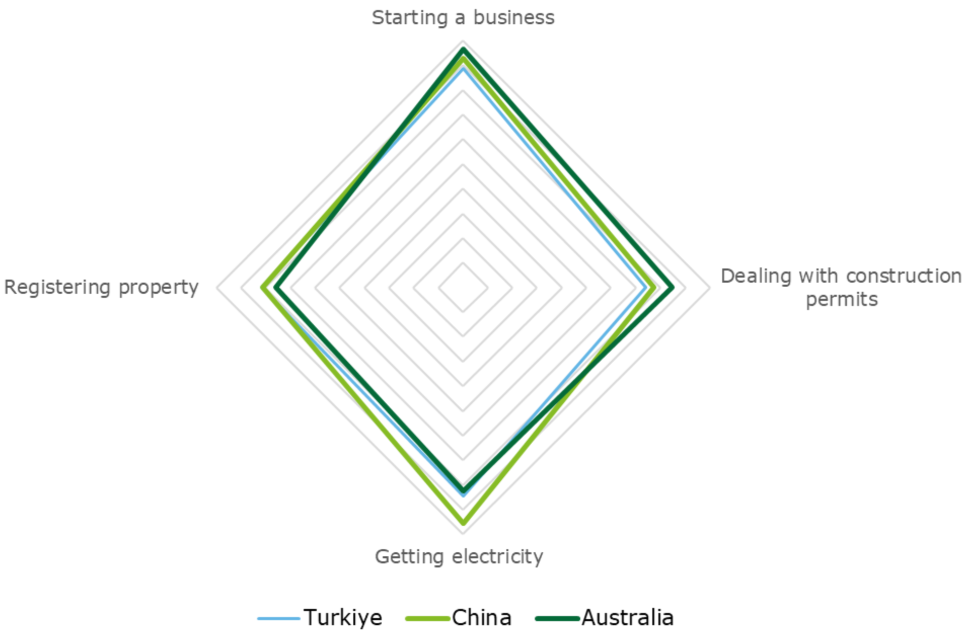
Chart A.42: Indices of labour market regulations, Türkiye, China and Australia



Source: ILO

Türkiye's regulatory barriers that apply to business development and construction are assessed as broadly similar to those of China and Australia according to the World Bank's Doing Business survey (Chart A.43Chart A.43).

Chart A.43: Indices of construction and business development regulations, Türkiye, China and Australia



Source: World Bank (2020).[cxii]

Regulation of textile wastewater effluent

Industrial zone effluent discharges are regulated by the Turkish Ministry of Environment and Forestry. While there has been some degree of non-compliance to effluent discharge standards[cxiii], there is a growing focus on emissions reduction and sustainable textile manufacturing owing to the introduction of the European Union's Circular Economy Action Plan.[cxiv] As Türkiye's largest export partner for ready-to-wear textiles, the regulatory environment in the EU is likely to influence standards for effluent discharge for Türkiye's textile industry. There is likely to be a growing focus on industrial wastewater recovery systems to reduce pollution and wastage from textile manufacturing.

A.6.4.2. Commercial and cultural barriers

When establishing business relationships in Türkiye, it should be noted that meetings and relationships begin slowly, with proceedings often beginning with pleasantries over Turkish tea or coffee before commencing the business agenda. The approach often used regarding pricing and finance can be subtle and happens slowly and never at the start of negotiations. Firms entering the Turkish market work with a local representative with local experience and knowledge. Austrade can assist Australian business in finding the right business partner for these ventures, utilising their team based in Istanbul.[cxv]

Türkiye's regulatory environment is business friendly and allows for fast establishment (within a day), where applications are correctly filed and lodged, regardless of applicant nationality or residence. Furthermore, property and contractual rights are enforced through written commercial and bankruptcy laws.[cxv]

Türkiye applies a number of goods taxes on imported products. VATs, strip stamp and consumption taxes can be applied particularly on luxury goods, machinery, vehicles and durable consumer goods. This impacts the cost of operating manufacturing plants in the country and can be passed on to the price of goods and at the point of sale. VAT and strip stamp taxes make up a significant part of the government's revenue, indicating a continuation of these policies for the foreseeable future.

The customs arrangement with the EU also helps to build further alignment of trade and tax policies in Türkiye. Congruence and increased similarities with taxes and regulations will help to ease trade between the two markets. Türkiye is still in the process of ratifying and aligning its policies which could present opportunities for Australian producers to have greater access to EU markets.

Selected indicators that quantify the cultural and commercial challenges of doing business in Türkiye are illustrated in Chart A.44. These indicators highlight that there are likely serious challenges for businesses operating in Türkiye compared to China and Australia. Türkiye displays significantly higher barriers with regards to currency inconvertibility, exploration risk, business environment risk, resolving insolvency and enforcing contracts. The exceptions being slightly lower barriers to trading across borders (due to integration with the EU) and slightly better protections for minority investors compared to China and Australia.

Chart A.44: Indices of commercial factors, Türkiye

Source: World Bank and Credendo (2022).[lxii]

A.7. Vietnam

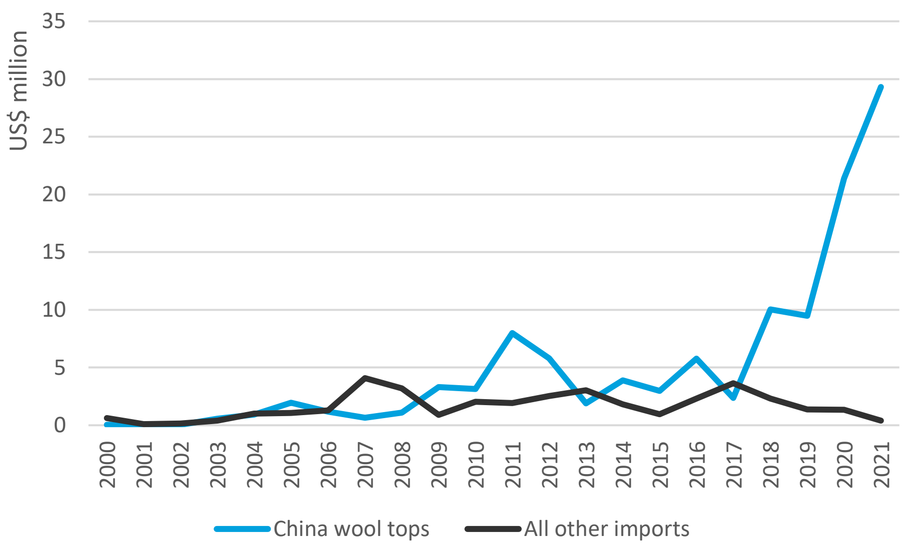
Vietnam's recent rapid economic development and growing middle class make it an increasingly important market for wool. In recent years, its wool imports have increased, with China supplied tops the dominant import. In comparison to many other markets, its total wool product imports trended higher even during the COVID-19 affected years in 2020 and 2021. Future demand for wool in Vietnam is projected to be relatively strong, underpinned by rapid economic growth and a shift towards manufacturing. Currently, Australian imports of wool into the country are subject to a 0% tariff under a free trade agreement. While NTM barriers have increased in recent years, in line with developing economies in the region, NTM use is still lower than other countries, such as China and India. All these factors make Vietnam a priority market for Australian wool.

A.7.1. Current market for wool

Vietnam is becoming an increasingly important market for global wool exports; however, the total value of Vietnam's wool imports is relatively modest at just US$22.7 million in 2020. The market has undergone rapid growth in recent years with the value of trade increasing more than 10-fold since 2017. Moreover, while most other importing markets saw declines in trade during COVID-19 affected years in 2020 and 2021, Vietnam's total wool product imports trended higher.

Vietnam's imports almost solely consist of wool tops from China with negligible trade in other wool? products or from other suppliers. This in part reflects restrictions on textile effluent which limits the ability to import greasy wool for scouring. Growth in wool tops imports reflects the recent expansion in customers (i.e. spinners) that have relocated in recent years (mostly from China).

Chart A.45: Vietnam imports of wool tops from China and all other wool imports



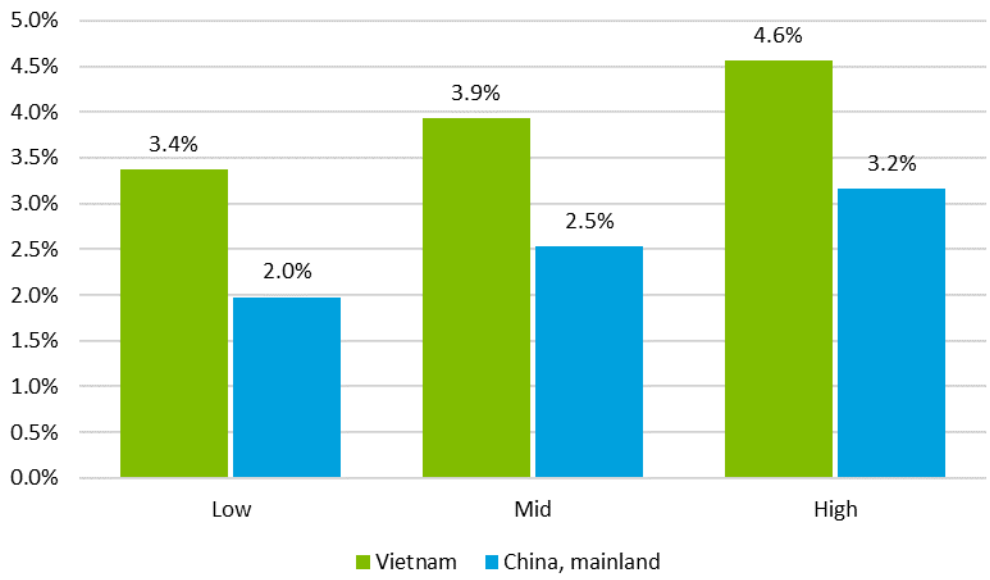
Source: UN Comtrade (2022).

Exports of raw and early stage processed wool are negligible, including in the context of Vietnam's wool imports. In the five years to 2021, Vietnam exported in total less than US$100,00 of greasy or semi-processed wool indicating wool imports are almost solely utilised within the domestic textile industry.

A.7.2. Future textile demand

Future demand for wool in Vietnam is projected to be relatively strong, underpinned by continued rapid growth in the broader textile industry. Between 2025 and 2050 value added in Vietnam's textile industry is projected to grow between 3.4% and 4.6% per annum. This rapid growth is more than double the world's largest textile market in China and is anticipated to see Vietnam's share of global textile production double to around 1.3%. Given this growth, and the integrated nature of Vietnamese wool imports, the country is not assessed as posing a risk from relocation of spinners or other customers or geographic shifts in demand.

Chart A.46: CAGR of textile value added to GDP (2025 to 2050), Vietnam and China



Source: DAE analysis based on World Bank (2022).

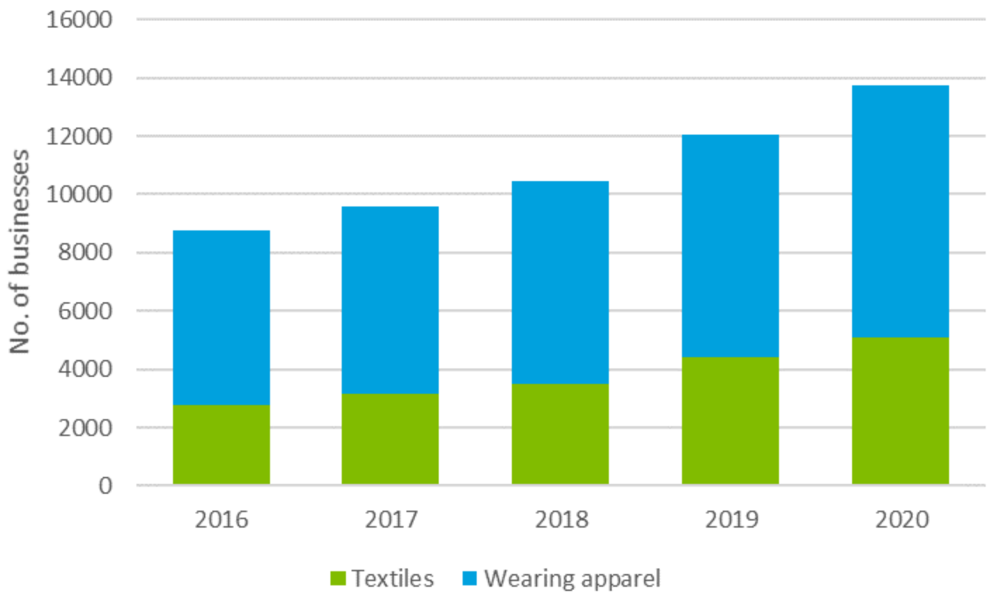
This growth reflects in part the expected rapid broader growth in the Vietnamese economy driven by strong growth in incomes and population size. Since 2000, Vietnam's annual GDP growth rate has averaged 5.8%, with growth remaining relatively high during the COVID-19 years of 2.9% and 2.6%. This growth has been driven by both a rapid increase in per capita incomes, but also an expanding population (which grew 36% between 2000 and 2021).

Future growth in Vietnam's textile industry is also expected to be supported by a transition of the economy to manufacturing and particularly to textiles. Between 2010 and 2020, the textile sector's share of manufacturing output increased from 10% to 16%. This has been compounded by a shift from agriculture, with the manufacturing sector's share of GDP rising from 13.7% in 2016 to 16.7% in 2020.[cxvi]

Growth in the Vietnamese textile and clothing sector has been broad-based but led by textile fibres between 2016 and 2020, which expanded 72% to 3.2 million tonnes (14.3% per annum on average). Similarly, rapid growth was also observed for fabrics (of all kinds) which grew 56.6% to 2.4 billion m^2, while clothes increased 21.1% to 5.2 billion pieces (11.8% and 4.9% per annum respectively).

Reflecting the communist structure of the economy, around 27% of economic activity is derived from state entities. However, in the textile industry, all production is made by private enterprises, joint-stock enterprises, and foreign-invested enterprises. As of end-2018, 2,225 foreign investment projects, valued at VND 17.4 trillion, were registered in the sector and these enterprises accounted for 59% of exports. Reflecting the dominance of private industry, most of the recent growth has been from new industry entrants. Since 2016 the number of textile and apparel businesses increased collectively by around 57% (11.8% per annum), with textile businesses expanding by just over 80% (16% per annum).

Chart A.47: Textile and apparel business numbers, Vietnam



Source: Vietnam GSO.[cxvii]

In support of continued growth, the Vietnamese government has a range of policies in place to support growth in the textile industry. The Prime Minister's Decision No. 879/QD-TTg, issued on 9 June 2014, approved the Industrial Development Strategy to 2025 and Vision to 2035.[53] Industries whose development is prioritized by the Strategy include textiles, garments, leather, and footwear, as well as many other manufacturing industries. The objectives set by the Strategy are that industry (including construction) will account for around 40% of GDP by 2035, and that industrial products in merchandise exports will reach 90% by 2025.

A.7.3. Trade and market access

A.7.3.1. Trade and investment openness

Vietnam is a key manufacturing centre for East Asia, the country has undergone great levels of development since the 1970s and is positioned as a key manufacturing hub for exportable goods. The country is well integrated within numerous global supply chains and has a track record of participation in global forums such as the WTO. Reflecting this, the ratio of trade to GDP has increased from an already very high 163% in 2013 to 210% in 2019.

A.7.3.2. Trade agreements and tariff access

Vietnam proactively participates in various free trade agreements, showing its rapid integration into the global economy. Entered into force agreements include FTAs with Australia and China and recently the European Union. South Africa and Vietnam have recently started discussions on developing a bilateral agreement.

While Australia has preferential access to the Vietnamese market,[54] MFN rates are set to zero for wool product imports into Vietnam. As such Australia has no tariff advantage when compared to other major suppliers such as China (which also has FTA access) or South Africa, which has no FTA. Applied tariff rates for wool imported into Vietnam are low, set at zero for greasy and clean wool products, as well as carded and combed wool.

Recent improved access to the EU market has provided Vietnam's textile industry with significant support. In 2020, the EU and Vietnam entered into force an FTA that provided the two countries with preferential trade access. Under the agreement, 99% of tariffs were eliminated, including for

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[53] The National Industrial Development Policy to 2030, Vision to 2045, is currently being drafted.
[54] through the Regional Comprehensive Economic Partnership, the Indonesia-Australia Comprehensive Economic Partnership Agreement and the ASEAN-Australia and New Zealand Free Trade Agreement.

textile industry products. This advanced access is comparable to that provided to LDC countries such as Bangladesh (although access here is anticipated to change in 2026).

Table A.11: Vietnam import tariffs for wool products

	Australia	China
Greasy wool	0	0
Scoured wool	0	0
Carbonised wool	0	0
Carded wool	0	0
Combed wool	0	0

Source: DFAT and WTO

Vietnam does not have a trade agreement with the United States, and consequently faces relatively high tariff rates for textile exports to the major export market. Trade relations with the United States are steadily improving (including through ASEAN multilateral engagement) after the major market opened to Vietnam in 1994.

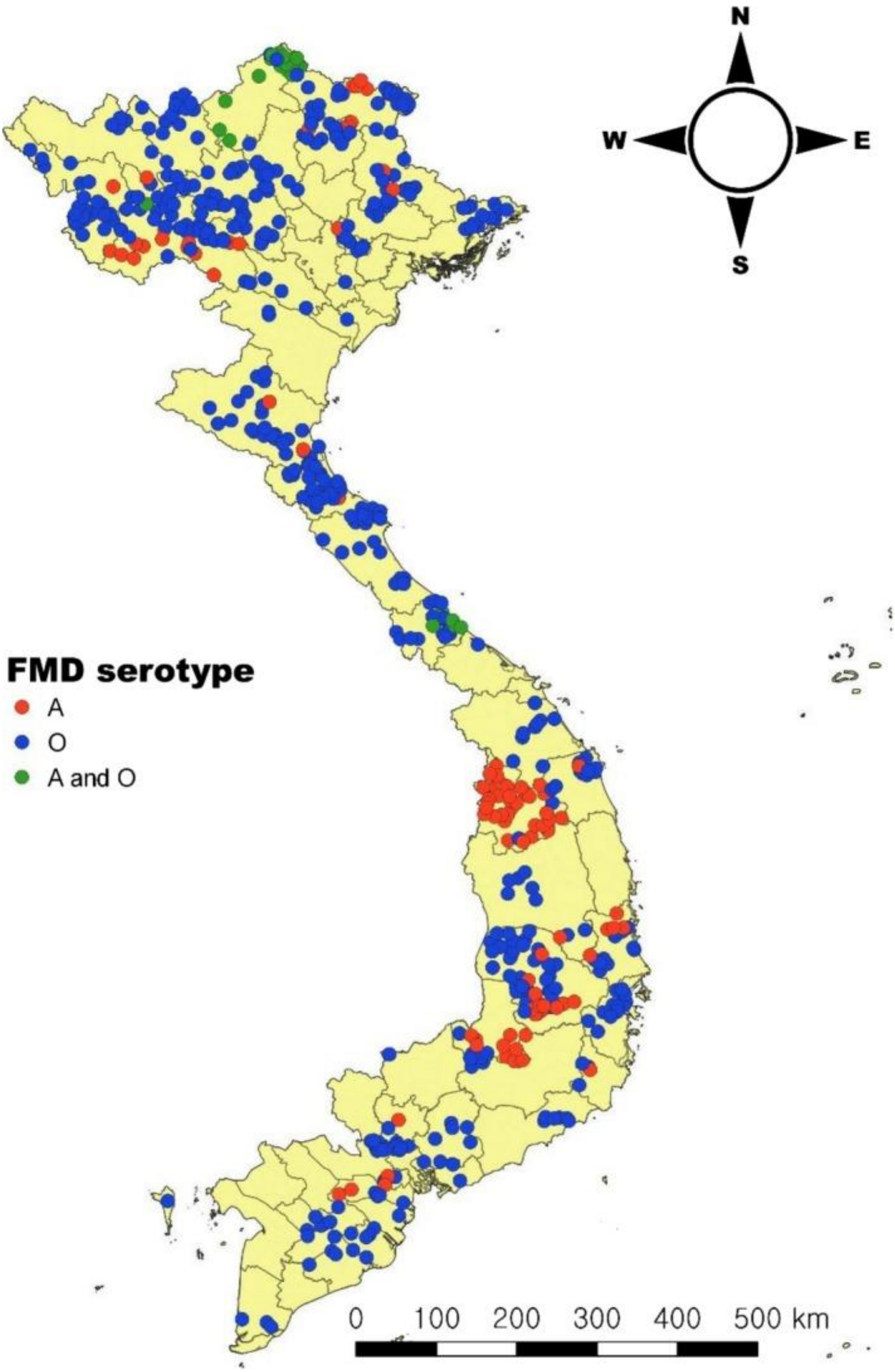
A.7.3.3. Sanitary issues related to animal disease events

Vietnam is assessed as having limited market access risk for Australian greasy wool if an animal disease event were to occur on domestic soil. This in part reflects the structure of Vietnam's imports, which includes only processed wool, and the obligation for such products to adhere to the principles established by the OIE. Vietnam currently imports other livestock products from FMD endemic countries. This includes India, which is Vietnam's major beef supplier, with trade currently valued at around US$80 million per annum. No trade in greasy wool or wool products was identified between South Africa and Vietnam before or after the former's 2022 FMD outbreak.

The limited risk posed by Vietnam also reflects the prevalence of animal disease issues in Vietnam, such as FMD. Lee, Pham and Wieland (2020)[cxviii] describe FMD as endemic in Vietnam, with cases found across local buffalo, cattle, pig and bovine populations. They also find that outbreaks occur with regular intervals, peaking during wet season months (Nov-Feb), and that most of the country's vast geography is affected.

Since 2006, Vietnam has had a national control programme in place. This includes vaccination of susceptible animals, as well as livestock movement controls and programs of disposal and disinfection. Vietnam's control programs run in phases of 5 years with the most recent phase concluding in 2020. A total of 26 provinces are targeted, mostly provinces that border Cambodia, Laos and China. Under the program, free vaccination is provided twice per year. For cattle and buffalo, vaccination occurs every 6 months but for pigs, vaccination is contained to large-scale pig farms and not administered by the government.

Figure A.3: Distribution of identified FMD serotype from 2007 to 2017 in Vietnam



Source: Lee, Pham and Wieland (2020).

A.7.3.4. Other non-tariff measures

Vietnam is assessed as having relatively strong coverage of NTMs with frequency indexes of 1.0 for agricultural goods and 0.89 for manufactured goods. This high score for manufacturing is also reflected in its coverage ratio (0.91) and prevalence score (3.8 NTMs on average), values which are comparable to that in China.

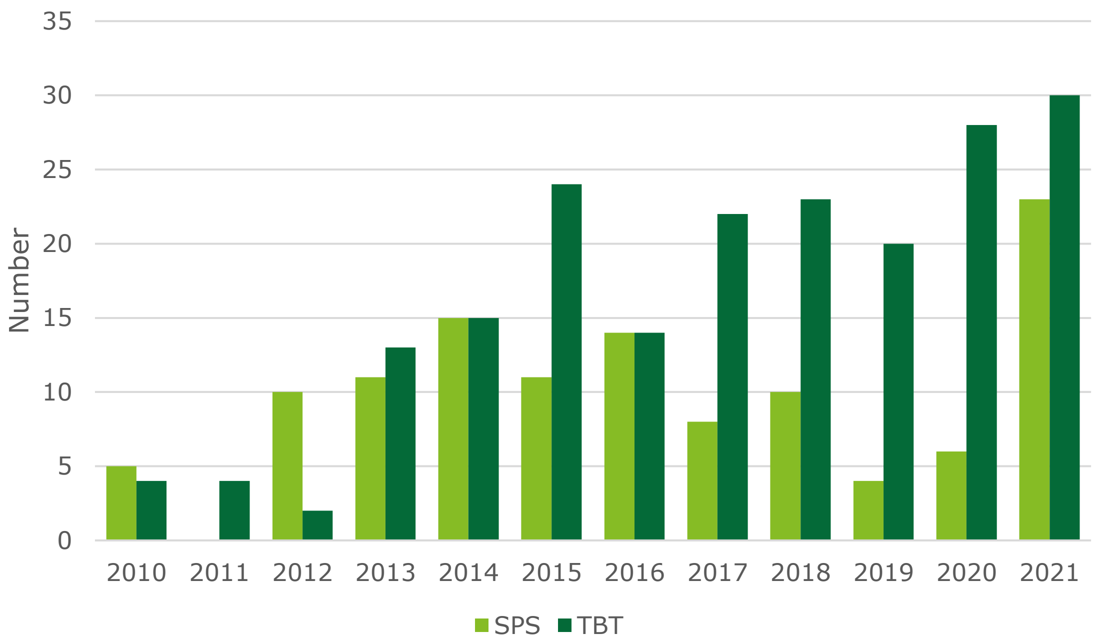
Table A.12: Agriculture and manufacturing NTM indicators, selected countries.

	Vietnam	China	Australia
Agriculture			
Frequency index	1.0	1.0	0.98
Coverage ratio	1.0	1.0	0.98
Prevalence score	17.6	22.8	16.1
Manufacturing			
Frequency index	0.89	0.89	0.63
Coverage ratio	0.91	0.90	0.72
Prevalence score	3.8	5.4	2.1

Source: UNCTAD (2022).[cxix]

In Vietnam, the use of non-tariff measures has proliferated in recent years reflecting general global trends among developing countries. In 2021, Vietnam had 30 TBT measures and 23 SPS measures in force, compared with a combined total of just 10 NTMs in 2010. At current levels, NTM use is considerably lower than other countries such as China, India or the EU and ranks fifth across ASEAN countries for use of NTMs.

Chart A.48: Number of Indian SPS and TBT NTMs in force, 2010 to 2021



Source: WTO (2022).

Regulations or technical standards applied to imports in Vietnam is less than other comparable countries. Moreover, many of the standards in place are assessed to not be applied in effect as they are under the control of multiple ministries or authorities and are complex in application. Standards imposed by Vietnam Standards are used as technical criteria for certification of conformity, quality registration and quality control for imported and exported goods. The number of standards developed was up to more than 7000, of which 4,400 are current and 100 are mandatory related to environmental hygiene, safety and strategic products.[cxx]

The non-tariff barriers imposed on imports into Vietnam appear to serve to help protect consumers and improve the transparency of product supply chains. A majority of the measures that are enforced and initiated are SPS and TBT, with most implemented between 2017 to 2021. There are many specific non-tariff barriers (SPS and TBT) in the form of specialised processes for importation and inspection criteria applied to garments. Labelling requirements on garments and the origination of material inputs could impact the importation of woollen products into the country. Strong recording and traceability of products will help to reduce the burden on importers and help wool producers in Australia position products abroad. There is also a prohibition on the importation of many used consumer and medical goods, which reduces importation for recycling and second-hand markets. These non-tariff barriers preference the production and consumption of domestic goods.

A strong and developing environmental policy within Vietnam has influenced the imposition of biosecurity and licencing of animals as well as their products. There are numerous prohibitions on the importation of goods that potentially affect the environment. The scope of these prohibitions includes items that could threaten biodiversity and existing livestock. This has direct implications for greasy wool, with the provision potentially used to limit the importation of wool from FMD, impacted jurisdictions. Australian imports may require extensive records or provisions to meet this requirement.

A.7.4. Other barriers

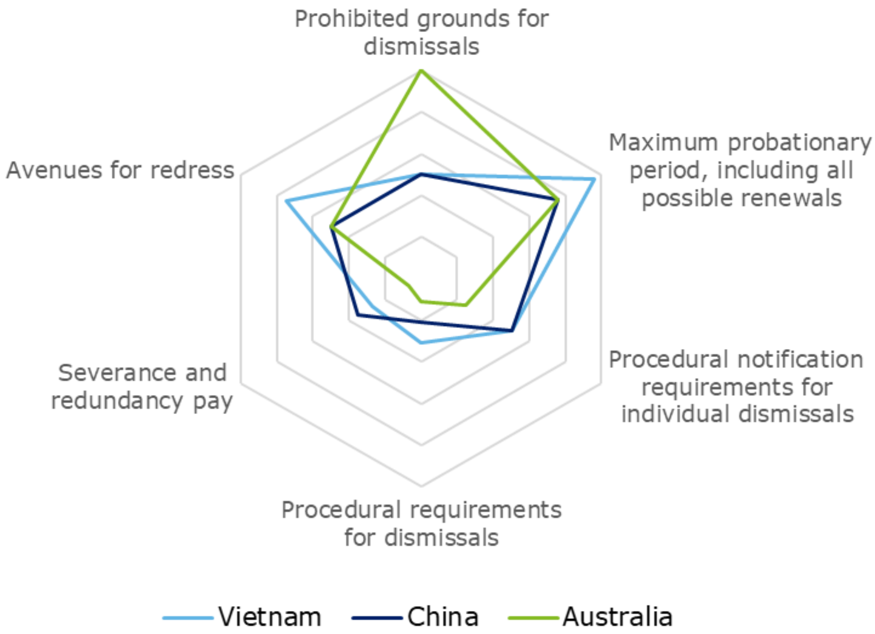
This section analyses barriers other than trade barriers (such as tariffs and NTMs) that may be faced if Australia's wool industry were to engage more strongly with Vietnam. In particular, regulatory barriers are discussed, including labour market regulations and construction and business development regulations, as well as commercial barriers.

A.7.4.1. Regulatory barriers

Regulatory barriers of particular importance for diversification of the wool supply chain through changes to early-stage processing include labour regulation (as the major input) and business development and construction regulations. A range of indicators have been selected to analyse the performance of shortlisted locations across these issues.

For labour market regulations (Chart A.49), Vietnam compares favourably to Australia and China, scoring about equal or higher than both on most indicators. Vietnam scores higher than both China and Australia on avenues for redress and maximum probationary periods. However, on prohibited grounds for dismissals, Türkiye's score is about equal to China's but much lower than Australia's.

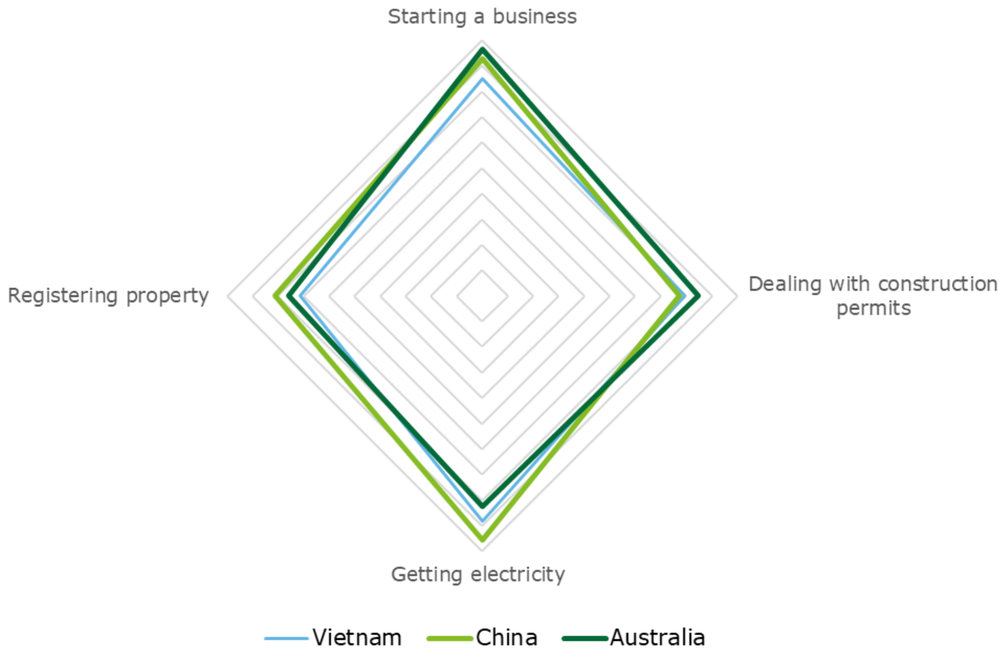
Chart A.49: Indices of labour market regulations, Vietnam, China and Australia



Source: ILO

Vietnam's regulatory barriers that apply to business development and construction are assessed as broadly similar to that of China and Australia, according to the World Bank's Doing Business survey (Chart A.50).

Chart A.50: Indices of construction and business development regulations, Vietnam, China and Australia



Source: World Bank (2020).[cxxi]

A.7.4.2. Commercial and cultural barriers

While boasting a very stable socio-political environment, the Vietnamese economy has also seen gradual liberalisation of its foreign investment and legal systems, to better align with commercial statutes and international laws. Despite this, Vietnam's economy can be very bureaucratic, with great value in personal contacts and connections, and is often subject to changing regulations. Establishing contacts and networks in Vietnam can be difficult, and often requires introduction via an existing contact or an official channel, such as Austrade.[cxxii]

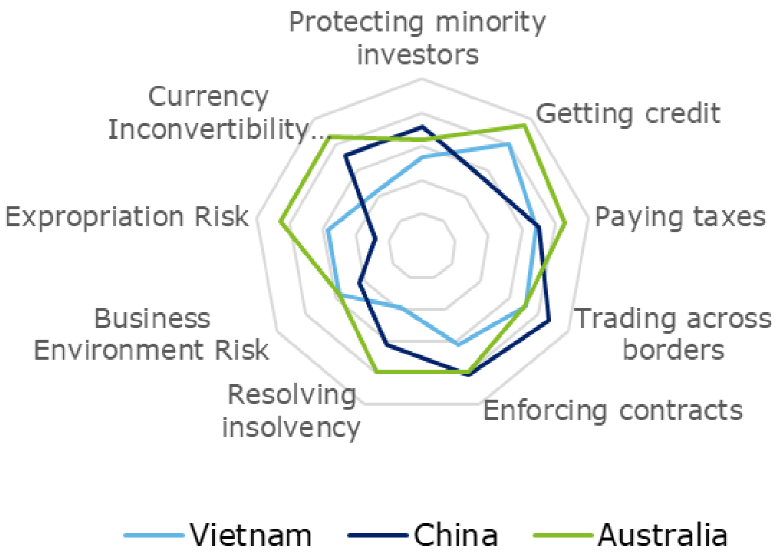
Businesses wishing to operate in Vietnam should also consider the difficulty of enforcing contracts, particularly for foreigners.[cxxii] As a result, it is encouraged that dispute resolution procedures be negotiated and included within contracts. While business disputes are heard by Economic courts, the related processes are notoriously tedious, long and difficult to navigate. As such, dispute resolution often occurs via Economic Arbitration Centres, some of which closely coordinate with the Vietnam Chamber of Commerce and Industry.

Many goods and services are subject to varying excise and environmental taxes. Machinery and automobiles, as well as the fuel they use, are subject to these taxes. The excise tax applied to motor vehicles ranges from 10 to 150% depending on the displacement and carrying capacity of the vehicle. Environmental taxes are applied to different fuels, including petrol. There are also value-added taxes (VAT) of 10% to which most goods are subject, with some exceptions made for the agricultural sector with a reduced VAT of 5%. Consultation with industry also revealed that there are challenges associated with importing second hand equipment into Vietnam, making it harder to grow manufacturing capabilities.

Taxes and incentives are used in Vietnam to support the development of domestic industries. Recently during the COVID-19 pandemic, the country established incentives for the development of its pharmaceutical industry. The government is involved in the economy through policy and its many state-owned enterprises. The presence of government within the economy would require WoolProducers to engage with state bodies in the event of establishing operations in the country.

Selected indicators that quantify the cultural and commercial challenges of doing business in Vietnam are illustrated in Chart A.51. Vietnam's scores show that significantly higher cultural and commercial barriers exist for businesses operating in Vietnam compared to Australia but it's a mixed bag when compared to China. Vietnam scores significantly higher than China for exploration risk and getting credit, but significantly lower than China for enforcing contracts and trading across borders.

Chart A.51: Indices of commercial factors, Vietnam



Source: World Bank and Credendo (2022).[lxii]

Appendix B: Cost of processing modelling

This appendix outlines the method, assumptions and results from modelling of processing costs in Australia and in overseas locations. Operating costs were modelled in terms equivalent to EBITDA (earnings before interest, taxes, depreciation, and amortization).

B.1. Core scenario assumptions

A summary of the key assumptions of the central wet and dry processing assumptions are described in Table B.1 and the following sections under this header.

For both the worsted and woollen system models, operating time was assumed to be 24 hours a day, 5 days a week for 48 weeks per year. The analysis undertaken here considers only an automated processing system that seeks to minimise labour inputs. Consultation with industry revealed that cost and labour inputs are broadly similar across modern scouring and top making systems. Reflecting the assumed peri-urban location, wastewater disposal is assumed to involve initial treatment on-site, with separated solid waste and effluent respectively disposed via trucked collection and municipal sewage.

Worsted system

For the worsted system, hourly wool throughput was assumed to be 2,300 greasy kilograms per hour. Annual greasy wool throughput was approximately 12.0 million kilograms, equivalent to 7.8 million kilograms of scoured wool. This is equivalent to processing 3.3 per cent of the total Australian wool clip.[cxxiii]

Table B.1: Central worsted scenario modelling assumptions

Parameter	Assumed value	Units
Annual wool throughput	12.0	million greasy kg/yr
Annual wool output	7.8	million clean kg/yr
Hourly wool output	1,500	clean kg/hr
Yield	65%	% of greasy weight
Micron	19-22	micron
Grease recovery	8.5%	% of clean weight
Scouring efficiency	95%	% of operating time
Site size	45,000	m^2
Total tops output	7.1	million kg/yr
Total noils output	0.7	million kg/yr
Average noil content	7.5%	% of tops weight
Top making efficiency	90	% operating time
Top making yield	92	%
Top making labour	55	FTE

Source: Deloitte Access Economics (2022).

Woollen system

Shorter wools under 25 microns as well as and broader micron fibres (26um - 28um) are assumed to be processed for the woollen processing system. Woollen processing is modelled to include scouring and carbonising, as well as carding activities. The differing inputs of the woollen system are assumed to be processed at a higher rate of throughput than the worsted system at around 2,280 kg clean per hour. Clean wool yields are also assumed to be lower in the woollen system than in the worsted system at 55% of greasy weight.

Table B.2: Central woollen scenario modelling assumptions

Parameter	Units	Assumed value
Annual wool throughput	20.4	million greasy kg/yr
Annual wool output	11.2	million clean kg/yr
Hourly wool output	2,308	clean kg/hr
Yield	55%	% of greasy weight
Micron	26-29	micron
Grease recovery	4.4%	% of clean weight
Scouring and carbonising efficiency	95%	% of operating time
Site size	50,100	m^2
Total carded output	10.8	million kg/yr
Total shoddy output	3.0	million kg/yr
Average shoddy content	4.0%	% of tops weight
Carding efficiency	90	% operating time
Carding yield	96	%

Source: Deloitte Access Economics (2022).

Labour, buildings and machinery costs

Table B.3: Labour requirement assumptions, per 24-hour period

	Scouring		Carbonising		Top making	
Section	Manager	Other	Manager	Other	Manager	Other
Production	1	22		9	2	27
Maintenance	1	6	1	1		9
Quality assurance						6
Logistics		5			1	4
Administration	2	2			3	3
Total	**39**		**11**		**55**	

Source: NSC Schlumberger and ABS (2022).

Table B.4: Wage assumptions

Role	Hourly wage (US$)
Managers	$36.68
Professionals	$35.14
Clerical and administrative workers	$23.94
Technicians and trades workers	$23.10
Machinery operators and drivers	$22.12
Community and personal service workers	$21.42
Sales workers	$18.90
Labourers	$18.90

Source: Australian Bureau of Statistics

Table B.5: Building and machinery cost assumptions (US$ million)

	Capital input	Building and land cost	Effluent treatment	Machinery costs	Total
Worsted	Scouring	$30.4	$2.5	$6.6	**$39.5**
	Top making	$20.2		$25.0	**$45.2**
	Total	**$50.6**	**$2.5**	**$31.6**	**$84.7**
Woollen	Scouring	$30.4	$2.5	$6.6	**$39.5**
	Carbonising	$12.6		$12.0	**$24.6**
	Carding	$14.1		$17.5	**$31.6**
	Total inc. Carbonising	**$57.1**	**$2.5**	**$36.1**	**$95.7**

Source: Deloitte Access Economics, Rawlinsons (2014)

Energy

Table B.6: Energy input assumptions

Stage	Electrical energy use (kW/h per clean kg)
Scouring	0.33
Carbonising	0.50
Carding	0.20
Top making	0.20
Total early stage - worsted	0.53
Total early stage - woollen	1.03

Source: Deloitte Access Economics

Table B.7: Energy cost assumptions

Source	Cost (US$)	Unit
Gas	$7.82	GJ
Electricity	$0.082	kWh

Source: Australian Energy Regulator. Note: Electricity prices are wholesale to allow for international comparison. A producer would need to pay an industry tariff, however, data on these costs is limited.

Consumables

Table B.8: Consumables costs per kg, by process

Process	Cost/kg (US$)
Scouring	$0.23
Effluent	$0.16
Carbonising	$0.23
Carding	$0.10
Top making	$0.20
Baling	$0.02

Source: Deloitte Access Economics

B.2. Estimated cost of early-stage processing in Australia

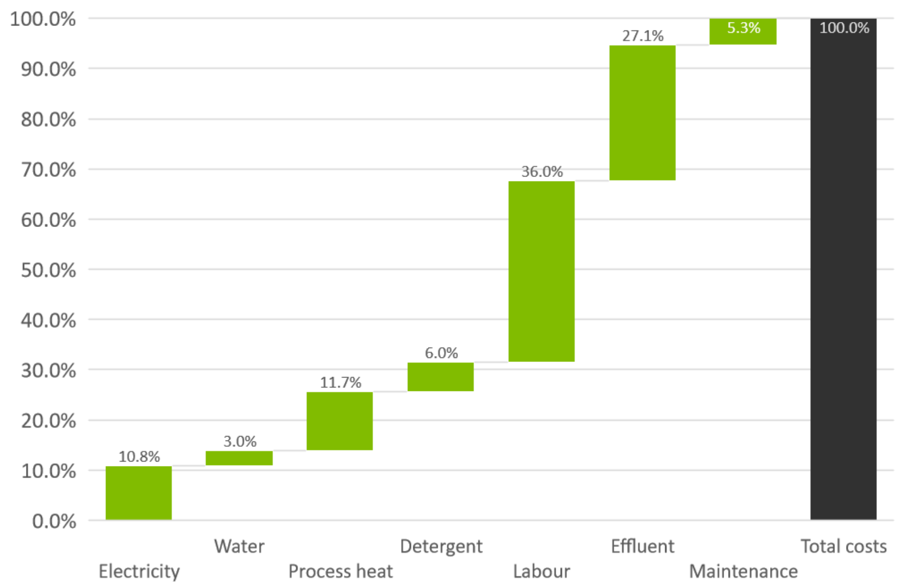
The following sections outline the estimated operational costs incurred during each stage of processing. Results are presented as cost shares.

B.2.1. Separated wet processing

B.2.1.1. Worsted scouring

Most costs incurred during wool processing are labour inputs. It is estimated that around 36 per cent of the total is labour. This finding is consistent with historical data which showed the costs of scouring in Australia were dominated by wages accounting for 40% of the total.[cxxiv]

Chart B.1: Cost shares, scouring



Source: Deloitte Access Economics (2022).

The consistently prominent share of labour costs is also consistent with data reported by the Australian Bureau of Statistics (ABS), which shows that labour use per $ of revenue improved only marginally in the last two decades. In the three years to 2000-01, the wool scouring industry registered 7.2 FTE employees per $ million in revenue. This compares with 6.3 FTEs per $ million in revenue in the three years to 2020-21.[xiii]

The degree of uncertainty in effluent treatment costs was confirmed in consultation with processors and other industry stakeholders. The variation in council charges alone is illustrated in Table B.9, which shows 2022 wastewater charges for the Barwon Water and Greater Western Water catchments.

Table B.9: Wastewater changes, Barwon Water and Greater Western Water

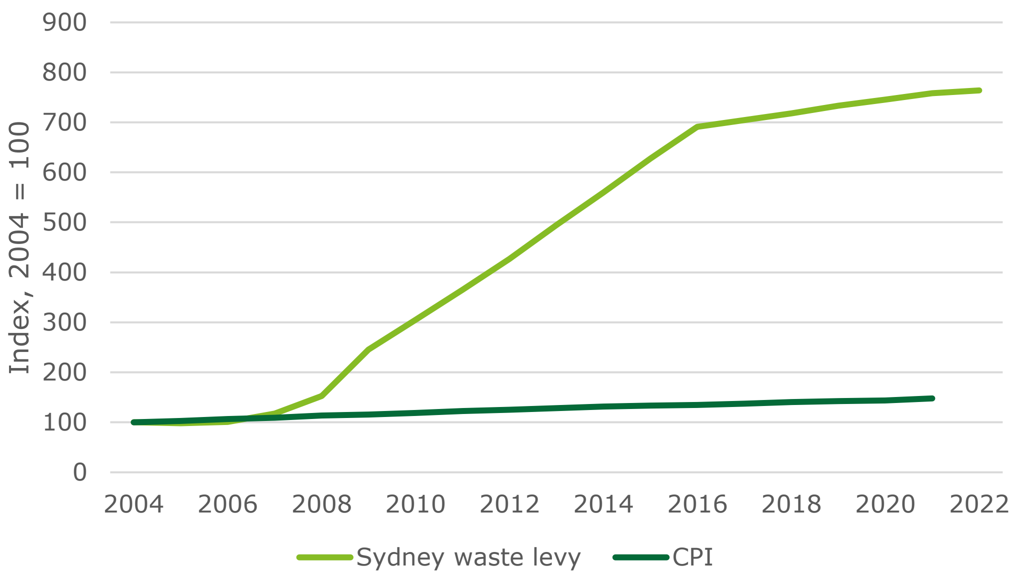
	Units	Greater Western Water rate	Barwon Water rate	Barwon Water notes
Volumetric charge	per kl	$0.90	$ 1.98	
Chemical oxygen demand charge >1,200 mg/L	per kg		$0.298 - $0.05178	>1,200 mg/L
Biochemical Oxygen Demand		$1.96		
Total Kjeldahl Nitrogen	per kg	$2.11	$1.3016 - $1.5676	>60 mg/L
Suspended Solids	per kg	$0.59	$ 0.22 - $0.30	>500 mg/L
Inorganic Total Dissolved Solids		$0.02		
Sulfur	per kg		$ 1.42	>50 mg/L
Phosphorus	per kg		$ 3.68	>14 mg/L

Sources: Barwon Water (2022)[cxxv] and Greater Western Water (2022).[cxxvi]

Effluent treatment costs have historically been shown to account for around 10 per cent of total scouring costs.[cxxiv] The growth in this share in part reflects a steady strengthening of environmental regulations in Australia, and associated costs of waste disposal. The rising cost of waste management in Australia is illustrated in Chart B.2 which describes a nearly 8-fold increase in the Sydney metropolitan solid waste levy between 2004 and 2021, alongside Australia's consumer price index, which rose 47 per cent during the same period.

Energy costs are comparable to historical estimates[cxxiv], despite a significant increase in nominal energy prices since the 1980s. This suggests that considerable energy efficiency gains have been realised by the industry during this period.

Chart B.2: Indices, Sydney metropolitan waste levy and CPI



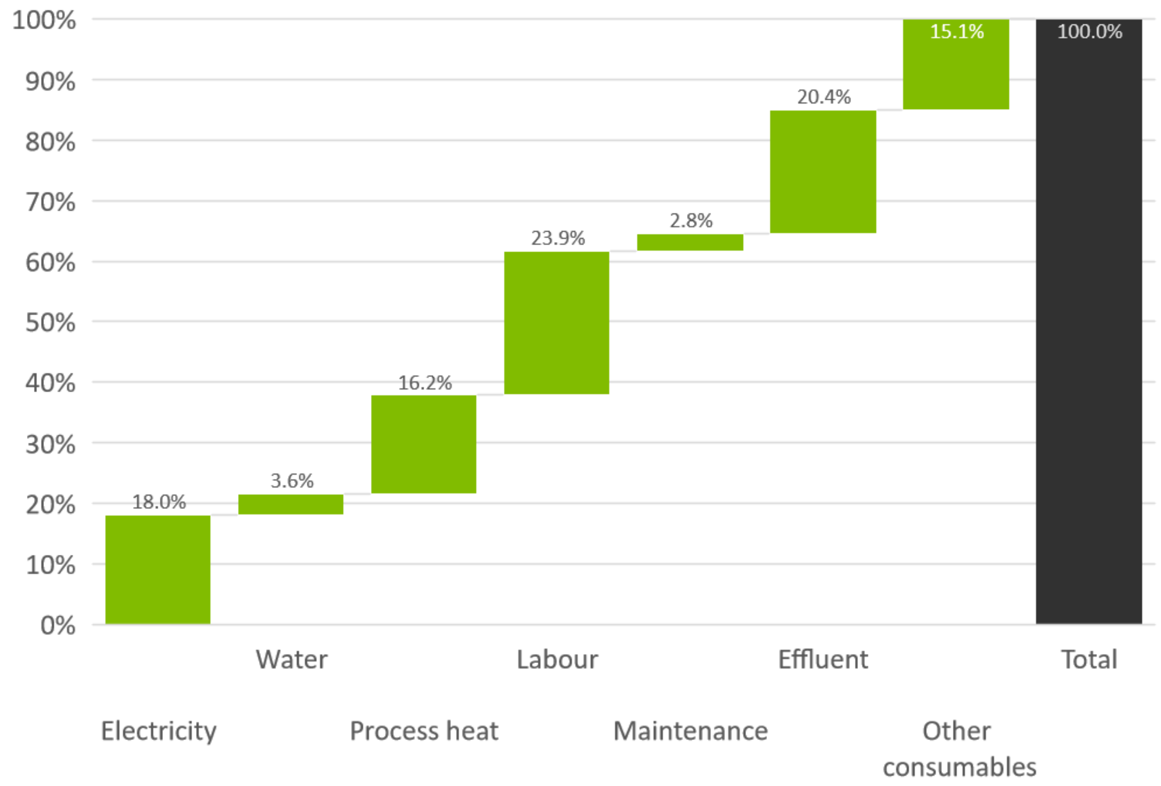
Source: MRA (2019)[cxxvii], ABS (2022) and NSW EPA (2022).

B.2.1.2. Woollen scouring and carbonising

Woollen system processing is comparatively more expensive. The unit cost is estimated at around a third higher than in worsted processing, reflecting the additional activities associated with carbonising. This is despite the higher annual throughput of the woollen system reducing scouring unit costs by around 13 per cent (mostly derived from the fixed cost inputs of labour and maintenance).

The cost structure of wet processing in a worsted system is spread more evenly across the inputs required for both scouring and carbonising of wool. The largest single item is again labour which accounts for 23.9 per cent of costs. Effluent treatment costs remain a significant component of wet processing woollen costs even with the additional carbonising activities, as well as electricity and process heat.

Chart B.3: Cost structure of wet processing in a woollen system



Source: Deloitte Access Economics (2022).

Note: Includes scouring and carbonising activities.

Integrated early-stage processing

This section outlines the cost structure of early-stage wool processing through to top making and carding in the worsted and woollen systems.

B.2.1.3. Worsted processing system

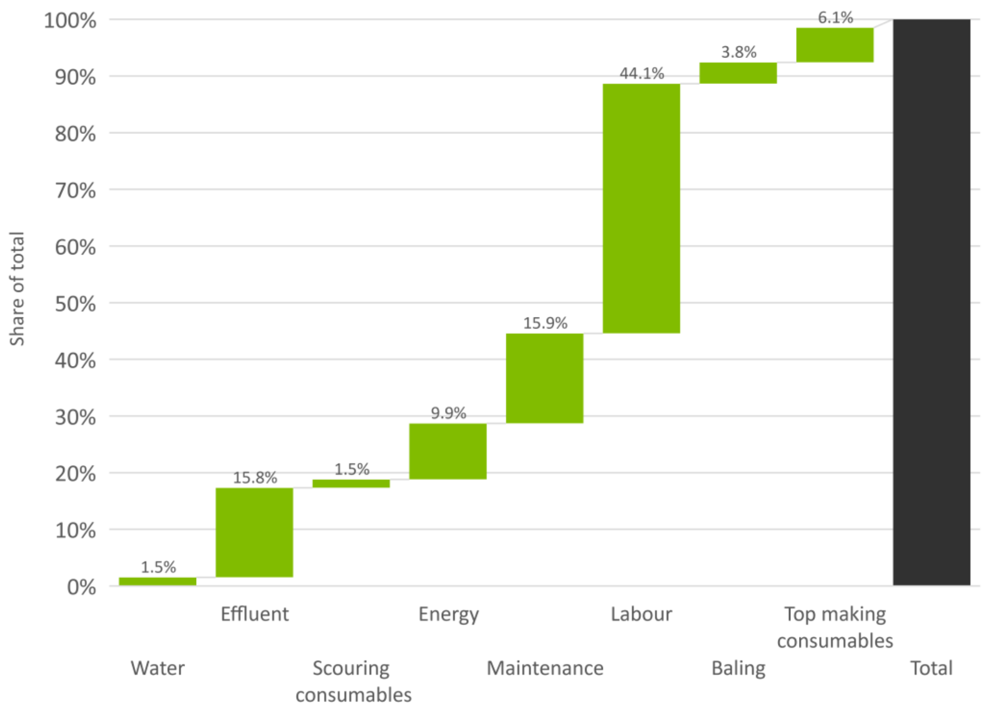
This section describes the estimated cost of early-stage processing in a worsted system, including scouring, carding, combing and gilling.

Consultation with industry revealed that managing the balance between scouring and top making capacity is complex. If not matched correctly, processors may be required to either limit top making or scale down scouring operations to suit the capacity of the dry processing equipment. Both trade-offs would result in inefficiencies in both labour usage and use of capital, leading to cost increases.

Top making's main inputs are labour, energy and maintenance. When aggregated into a full worsted processing system, total costs are more concentrated on these items. For the top making activities alone, labour is estimated to account for 44 per cent of costs.

For a fully integrated worsted processing system it is estimated that labour accounts for around 44 per cent of operating costs (Chart B.4). This reflects labour's dominance in top making, and the overall larger costs incurred during this stage of processing. Machinery maintenance is the second largest cost item, resulting from the intensive capital requirements for top making (on top of scouring). Effluent treatment costs remain significant at 15.9 per cent of total for an integrated worsted processing system.

Chart B.4: Cost shares, integrated top making enterprise



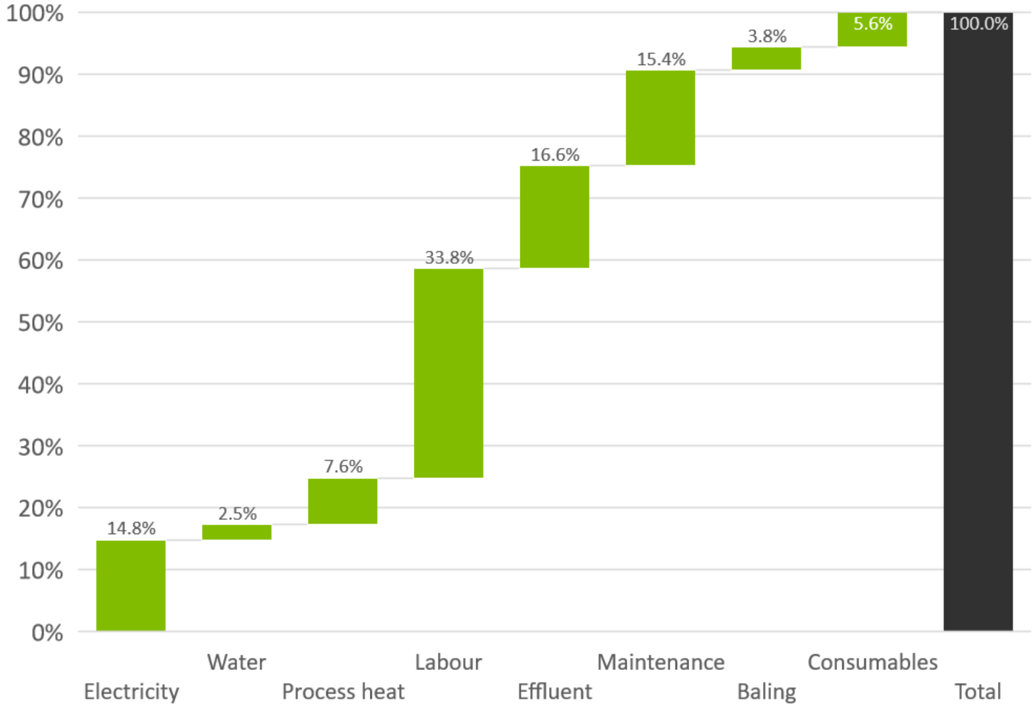
Source: Deloitte Access Economics (2022).

B.2.1.4. Woollen processing system

This section outlines the major cost components of an integrated woollen processing system that includes scouring and carbonising, as well as carding.

As with the worsted processing system, labour costs are the most significant component of processing costs (33.8 per cent of the total). However, the central role of labour is moderated, with costs spread across a range of other activities including those involved in carbonising. Maintenance, electricity and effluent costs each account for a further 15 per cent of costs, followed by process heat (7.6 per cent).

Chart B.5: Component cost breakdown of woollen processing system



Source: Deloitte Access Economics (2022).

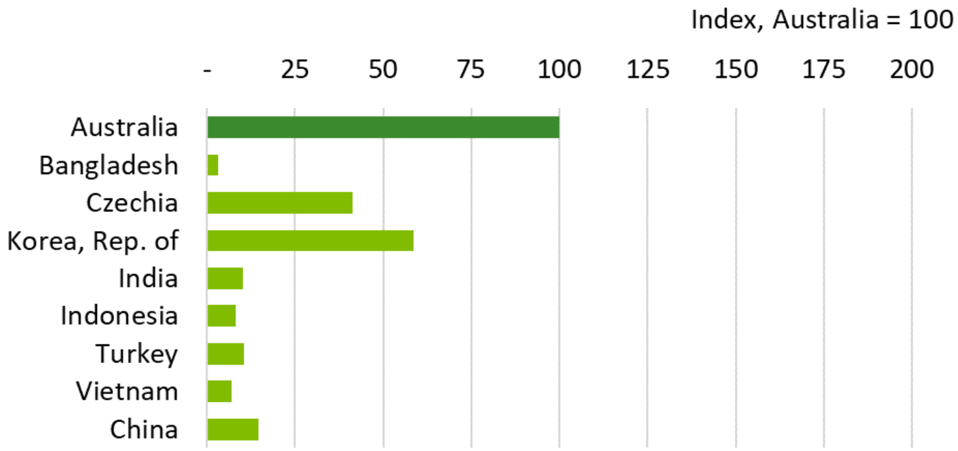
B.3. Assumptions for international processors

Price inputs for selected parameters were adjusted to allow for the comparison of costs for processing in international locations. The analysis employed two methods; where full data was available, international input costs were scaled based on the relative change from the Australia's value. For example, if wages were shown to be half the hourly rate of Australia, the total wage bill for that country was scaled by a factor of 0.5. Sufficient data was available for manufacturing wages, electricity and gas prices and water prices.

The least amount of information was available to estimate effluent costs. In place of appropriate data, the analysis adopted the approach of Zessner et al. (2010).[cxxviii] This method estimates a bottom-up cost of wastewater processing for each country based on the costs of labour, electricity, water and sludge waste disposal costs. Sludge costs were taken from an OECD global input-output table.[cxxix] The cost of sludge disposal was estimated in $/tonne based on the output and total municipal solid waste produced in the waste management industry in each country.

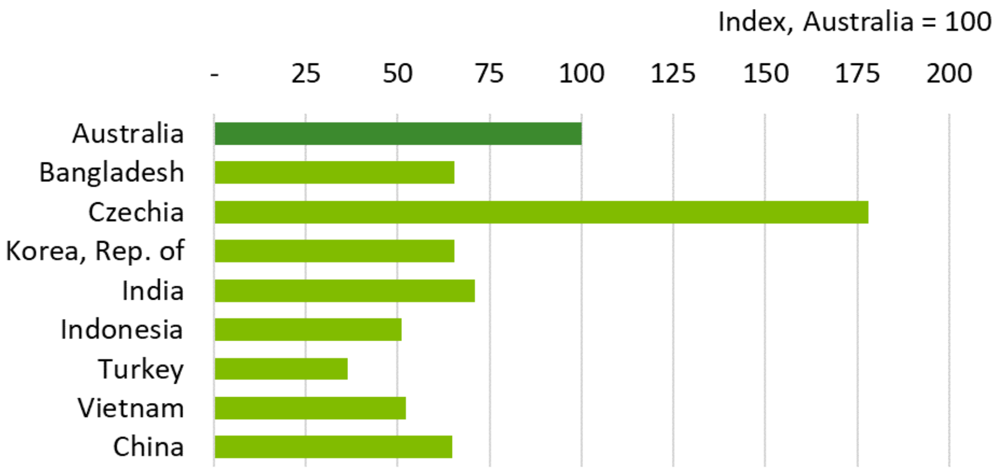
The scales used to adjust these inputs are shown below.

Chart B.6: Index of manufacturing wages, relative to Australia



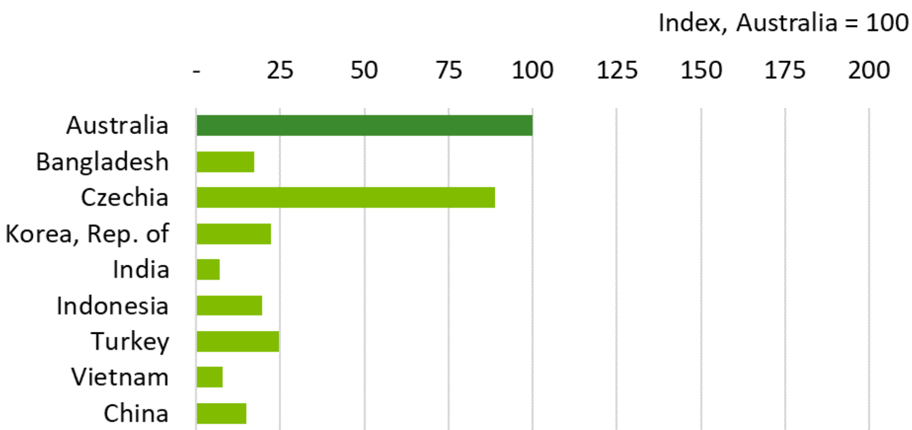
Source: JETRO (2019) and ILO (2022).

Chart B.7: Index of electricity prices, relative to Australia



Source: Globalpetrolprices.com (2021).

Chart B.8: Index of water prices, relative to Australia



Source: Holidu (2022).

Appendix C: Sensitivity analysis of modelled processing costs.

Sensitivity testing is an important aspect of any modelling, during which key assumptions and inputs are varied to assess their impact on estimates. Here a range of sensitivities are performed that test key assumptions and inputs of the cost of processing modelling.

C.1. Scouring machinery configuration

Before selecting a central scenario for modelling, the analysis considered a range of possible processing configurations. This primarily analysed how the number and width of working scours influenced viability of a scouring enterprise.

Three scour width sizes (1.2, 2 and 3 metres) were considered, with one scour size (3m) ultimately used for the main analysis. All other variables as in the central scenario were held constant. Results given here relate to the processing of 19–22-micron wool. However, the results are consistent across other micron categories and woollen and worsted systems.

A 1.2 metre scour unit is estimated to cost 57 per cent more per kilogram of clean wool despite producing less than half as much as a 3-metre scour. Similarly, a 2-metre scour is estimated to be around 20 per cent more expensive on a per kilogram basis.

Table C.1: Impact of scour size on relative processing cost per kilogram

Scour size (metre)	1.2	2	3
Relative cost per kg	1.57	1.19	1
Clean wool output (kg)	3,119,040	5,198,400	7,797,600

Source: Deloitte Access Economics (2022).

The results reflect the fact that labour requirements are broadly the same across scouring units of different sizes. Therefore, smaller scour units are unable to process enough wool to make efficient use of this labour and distribute costs over a greater volume of production. This highlights the importance of reaching scale quickly and maximising production to offset extremely high fixed costs of production.

These results are in line with industry expectations which suggest there would be no commercial interest in establishing a scour smaller than three metres.

The addition of a second or third scouring line has the potential to offer even greater labour efficiency. However, this would need to be balanced with the greater capital outlays and risk of underutilised capital, if scoured wool demand fails to meet the throughput levels required to moderate costs.

C.2. Labour use and wages

Labour is a critical input to most manufacturing industries, including the processing of wool. Its central role in early-stage processing has been explored in Section 4 of this report, where labour costs are estimated to account for 36% of operational costs in scouring and 48% of the top making operational costs for a stylised processor in Australia.

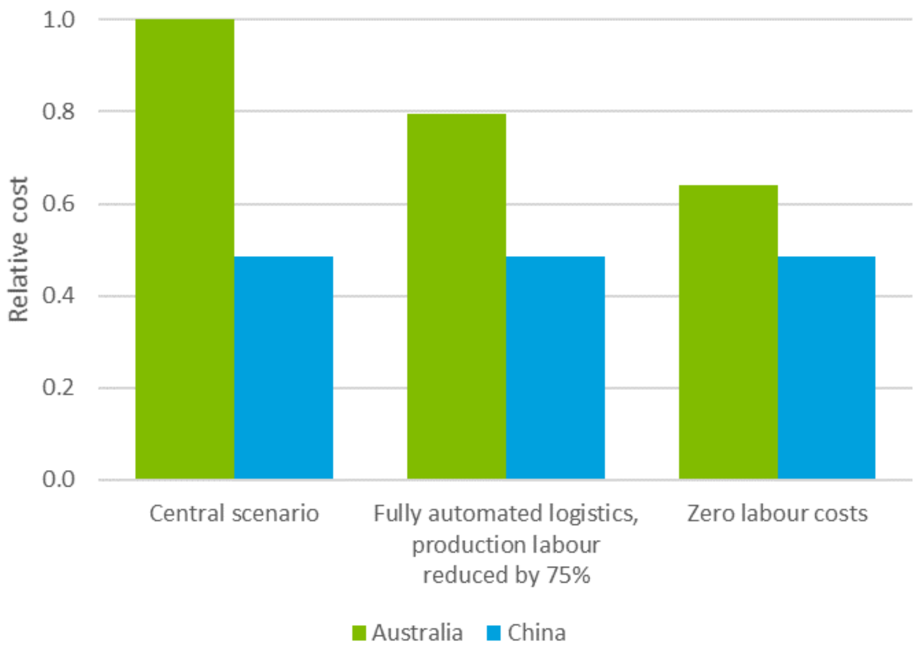
Australian industry data also shows that labour use has remained relatively constant over the long term, despite significant structural adjustments in the industry. In the three years to 2000-01, 7.2 persons were employed in early-stage processing per million dollars of industry revenue. This compares with 6.3 persons in the three years to 2020-21 and represents a reduction of 12.6% over 20 years (0.6% per annum on average).[xiii]

While this analysis has shown Australia has the potential to compete on a delivered costs to customer basis, high labour costs are still a significant concern for industry when it comes to enterprise viability. The potential of automation has often been raised as one way to address this issue.

This sensitivity considers how much reducing labour costs may influence cost competitiveness with the main industry competitor, China. The results of the central scenario used in the main body of the report are compared with a scenario where logistics labour is completely automated and production labour is significantly reduced. It is also compared to a scenario where labour costs are totally removed. This test does not consider whether these changes are operationally feasible, only to examine the absolute maximum gains that reducing labour costs could have.

In the central scenario, Chinese scouring is estimated to be half as costly as in Australia. Removing all logistics costs and reducing the labour required for scouring (that used for operating machinery and overseeing production) by 75 per cent reduces scouring costs by 20 per cent. If labour costs are completely removed, overall scouring costs are reduced by more than one third.

Chart C.1: Australian scouring costs relative to China for different operational labour configurations



Source: Deloitte Access Economics (2022).

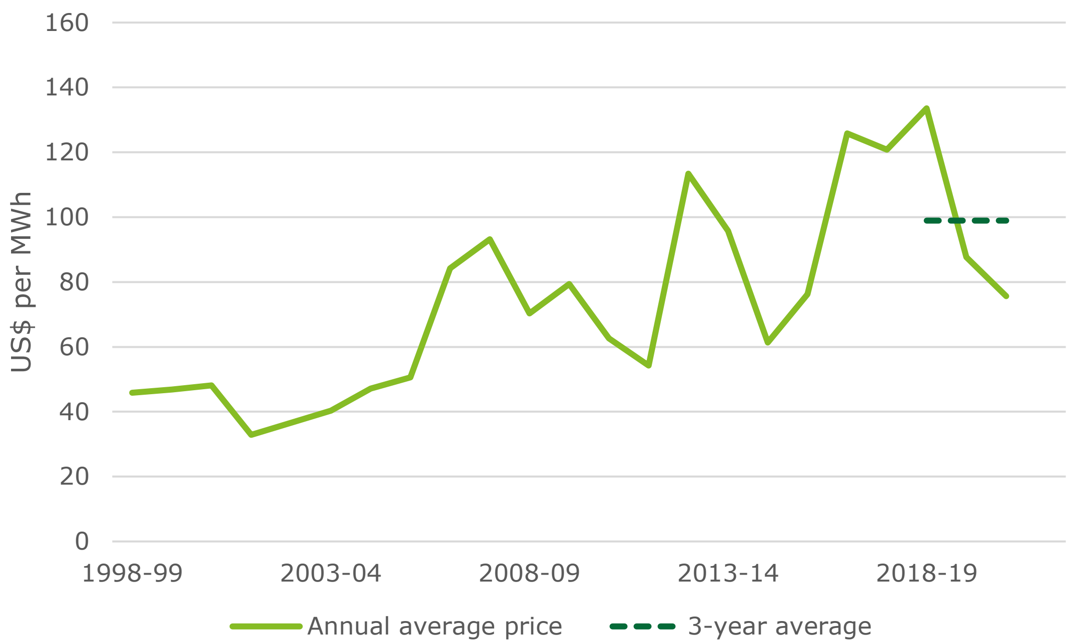
Even with labour costs eliminated, scouring in Australia is still estimated to be more expensive than in China. These results highlight that while automation may help improve Australia's international competitiveness, it is unlikely to completely solve the problem.

C.3. Energy use

Energy is a small but important contributor to early-stage processing inputs. For scouring, electrical energy and thermal heat account for around 10.5 per cent of operating costs, and for top making electrical energy accounts for 3.7 per cent of costs.

Energy prices have historically trended upwards and have recently come under significant pressure during the energy crises of 2021-22. According to the International Energy Agency, wholesale electricity prices have risen particularly in Europe and less so in Australia and India.[cxxx] While discrepancies remain in the short-term, energy prices are linked through globally traded fuel commodities. As such, long-term changes to input costs are likely to be mirrored in overseas locations and therefore have only a modest impact on international competitiveness.

Chart C.2: Historical Australian wholesale energy prices, average $ per MWh (real)



Source: Australian energy market regulator

However, it is possible that competitiveness may be materially altered in the context of global decarbonisation as outlined in Section 7. Once installed, renewable energy can be produced at almost zero marginal cost. Emissions are also a key supply chain concern when considering consumer preferences and the future strategic direction of the wool industry.

Based on this, a sensitivity test is performed to understand how adoption of green technologies may impact firm-level operating costs in Australia. This is performed only on a worsted system operating in line with the central scenario outlined in Appendix B. Using the parameters of the central worsted system, the HOMER[cxxxi] modelling package was used to optimise system configurations.[55]

The results of the optimisation find that for a scouring facility, including solar PV reduces the levelised cost of electricity (LCOE)[56] by more than 75 per cent and results in a system that is 81 per cent renewable.[57] The annual savings to the central worsted system scour from installing

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[55] HOMER has been used previously by CSIRO to examine the techno-economic feasibility of introducing renewable energy (photovoltaics and batteries) into various remote area power system and grid sites.

[56] The standard formula for levelised cost (LC) is:

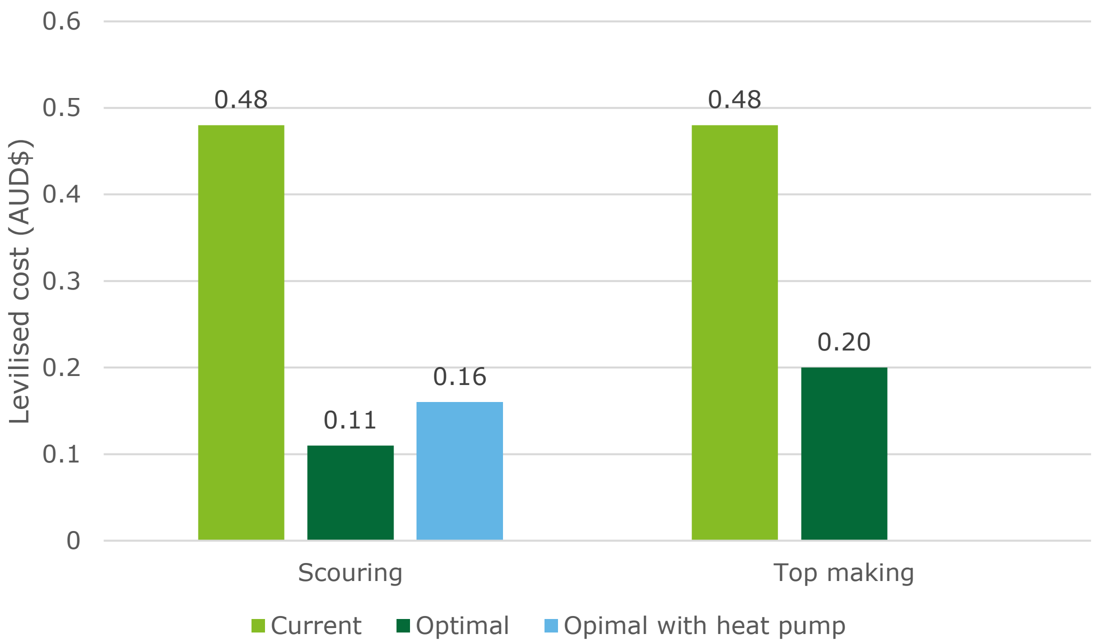
$$LC = \frac{r \times (1+r)^L}{(1+r)^L - 1} \times \frac{K}{P} + \frac{O\&M_{FIX}}{P} + O\&M_{VAR} + \frac{F \times P}{E}$$

Where r is the discount rate (5.9%), L is the lifetime, K is the capital cost in $, P is the annual production in MWh for electricity and GJ for heat, $O\&M_{FIX}$ is the fixed operations and maintenance (O&M) cost in $, $O\&M_{VAR}$ is the variable O&M cost in $/MWh or $/GJ for heat, F is the fuel cost in $/MWh and E is the efficiency.

[57] It was not economic to install batteries, particularly as excess renewables are sold to the grid.

rooftop solar PV is estimated to be a reduction of around 30 cents in the levelised cost per kilowatt hour. If excess generated electricity is not sold to the grid but is instead used to power a heat pump hot water/steam generator, the LCOE is estimated to be slightly higher at $0.16 per kWh. This is because grid purchases are higher, and sales are lower.

Chart C.3: Levelised cost of electricity, central scenario and modelled optimal renewable system



For a top making facility, the inclusion of the largest rooftop solar system possible results in a system that is 61 per cent renewable and reduces the cost of supplying electricity by more than half.

Alongside the savings to LCOE, such a renewable system could deliver substantial emissions reductions. The existing gas system for example is estimated to create direct onsite emissions of 133,978 tCO_2-e per annum. This contrasts with electric systems which have indirect emissions through the grid. These Scope 2 emissions are location dependent, but if located in NSW for example, the heat pump and electric resistive heater account for 1,469 tCO_2-e and 5,200 tCO_2-e respectively, significantly lower than the direct emissions contribution of gas.

C.4. Effluent and other waste disposal

Effluent treatment costs are the second biggest contributor to scouring costs, estimated to account for around 27 per cent of the total. The cost of effluent treatment includes onsite treatment, the disposal of solid waste and council charges for sewage disposal, with precise value for these items being varying considerably depending on geographic location. The driver of these costs includes the location of scouring, as this would be expected to influence both the level of charges faced from council for disposal of effluent, and access to markets that would accept the solid waste disposal.

This analysis considered a scouring facility located in a peri-urban area. This location required the assumption of a standard water and effluent treatment facility where initial treatment is performed on-site, with separated solid waste and effluent respectively disposed via trucked collection and municipal sewage.

However, alternative models could exist including a regionally placed scour. Locating in a regional area with less costly land resources offers the potential for effluent to be biologically treated using a lagoon or constructed wetlands treatment system.

Expert advice indicates that an initial physio-chemical first-stage process such as Sirolan CF with limited aeration followed by a wet land or evaporation ponds offers the greatest potential from both a capital and operating expenditure perspective.

Much like trade waste discharge costs, initial outlays and running costs are highly dependent on geographic location. Most of the investment would be civil construction whilst the size of the scour line and local relative humidity of the region would also be important factors.

By avoiding waste discharge costs, a more comprehensive effluent treatment system has potential to offer considerable costs savings. However, these would need to be balanced with potential challenges involved with processing in a regional location that could impose extra costs. This includes additional transport legs involved with moving away from a more traditional hub and spoke supply chain. This is the structure most associated with Australia's ports and nearby processors for receiving greasy wool. There may also be logistical obstacles, such as securing freight containers distributing clean product.

Strategic location decisions would therefore be critical, perhaps taking advantage of low-cost freight options such as rail. For example, the Uruguayan processor Lanas Trinidad is located 2.5 hours from the major port in Montevideo but sits within a broad receival catchment and transport network that allows it to take delivery from all parts of the country.

Placement of a scour in a regional location also offer the possibility of using effluent water for agricultural irrigation.

C.5. Firm-level profitability factors

Firm-level profitability reflects revenue which is determined by two separate income streams. During the wet stages of processing, wool scouring recovers wool grease for resale, and tariffs are charged for commission-based services across scouring, carbonising, carding and top making. For both wet and integrated processing systems, these two income streams are interrelated with tariffs set based on expected grease recovery during scouring.

Wool grease is a globally traded commodity, meaning prices received will be similar across countries. While the price of wool grease is an important driver of profitability at a firm level, it is not a source of international competitiveness.

The price of wool grease has been highly variable. While the long term (1988 to 2021) average of Australian export prices sits at around US$3.03 per kilogram, prices peaked at US$7.31 a kilogram (real) in 2012 and were as low as $0.66 per kilogram in 1994 (Chart C.4).

Consultation with industry advised that tariffs were set on an individual consignment basis and are determined by factors including wool attributes (such as its micron),[58] expected recoverable grease content and the prevailing grease price. Based on advice from industry, prevailing scouring tariff rates range as wide as US$0.30 to US$0.70 cents per kilogram clean.

With significant variability in wool grease prices possible, tariffs charged by scours and the point at which an enterprise would breakeven both have the potential to vary markedly.

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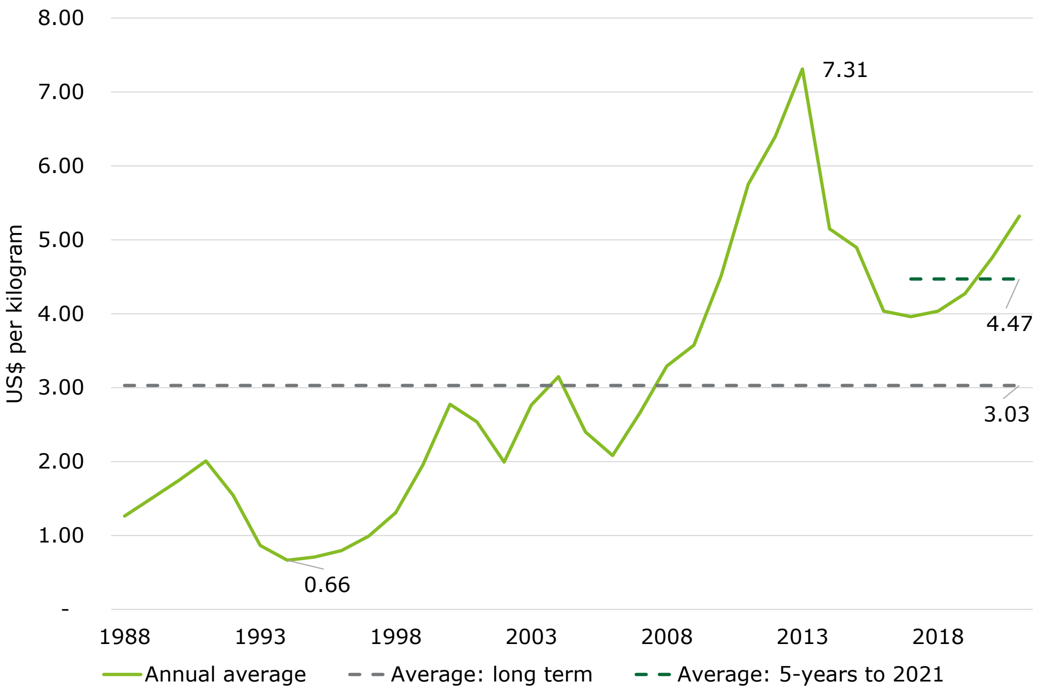
[58] Fine wools typically receive a higher tariff compared to coarse wools due to their inherent physical characteristics. Merino has an average grease content of 15 per cent, while coarser wools would more typically display a grease content of around six per cent.

Chart C.4: Real export price of Australian wool grease, 1988-2021



Source: UN Comtrade (2022).

Note: Commodity code HS1505 (wool grease & fatty substance derived therefrom, incl. lanolin).

Appendix D: Economic impact modelling

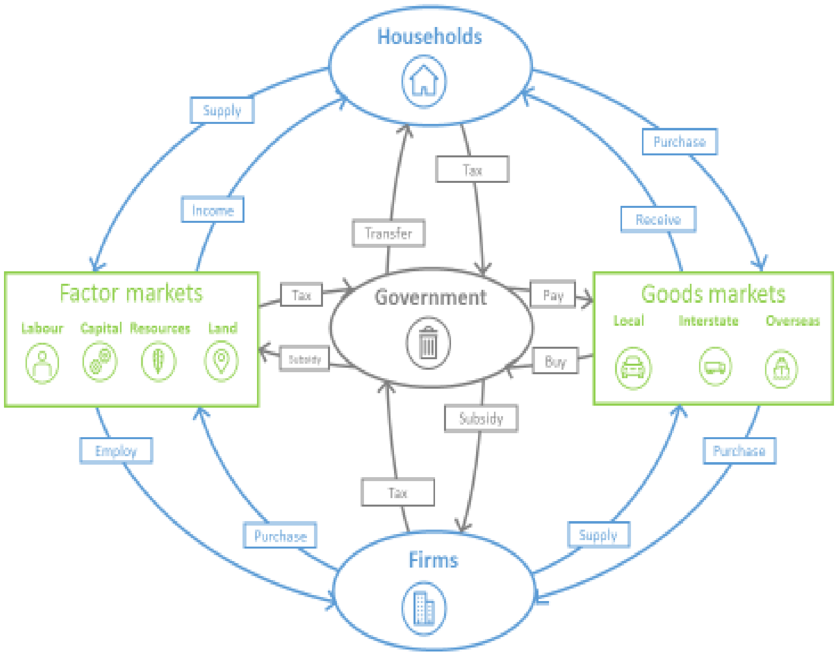
This appendix outlines Deloitte's in-house CGE model: Deloitte Access Economics' Regional General Equilibrium Model and describes selected sensitivity tests undertaken as part of the economic impact analysis outlined in the report.

D.1. Computable General Equilibrium (CGE) Modelling

The project utilised the Deloitte Access Economics' Regional General Equilibrium Model (DAE RGEM). DAE-RGEM is a large scale, dynamic, multi-region, multi-commodity CGE model of the world economy with bottom-up modelling of Australian regions. DAE-RGEM encompasses all economic activity in an economy – including production, consumption, employment, taxes and trade – and the inter linkages between them.

Figure D.1 gives a stylised representation of DAE-RGEM, specifically a system of interconnected markets with appropriate specifications of demand, supply and the market clearing conditions determine the equilibrium prices and quantity produced, consumed and traded.

Figure D.1: The components of DAE-RGEM and their relationships



Source: Deloitte Access Economics

For this project, the default DAE-RGEM has been modified to reflect the unique modelling task at hand. The aggregation components are outlined in Table D.1 and covers geographic and industry dimensions.

Table D.1: CGE model database aggregation

Dimension	Methodology	Notes
Geographies	The following regions were uniquely identified: • Australia • South Africa • New Zealand • South America (including • Greater China (including mainland China and Hong Kong) With all remaining locations included in a rest of world region.	The GTAP database provides detailed economic data for 141 countries. Regions selected here are identified due to their key role in the supply chain either as wool producers or processors.
Sectoral	Aggregation corresponding to ANZSIC 19 with wool production on farm uniquely identified, alongside textile manufacturing, which was split into three sub industries, early-stage wool processing (wet and dry) and other textile manufacturing.	The GTAP database provides detailed economic data for 65 industries. Industries are uniquely identified to capture selected stages of the wool supply chain including on farm production and wool processing.

Source: Deloitte Access Economics (2022).

DAE-RGEM is underpinned by the following key assumptions:

- All markets are competitive, and all agents are price takers
- All markets clear, regardless of the size of the shock, within the year.
- It takes one year to build the capital stock from investment and investors take future prices to be the same as present ones as they cannot see the future perfectly
- Supply of land and skills are exogenous. In the business-as-usual case, supply of natural resource adjusts to keep its price unchanged; productivity of land adjusts to keep the land rental constant at the base year level.
- All factors sluggishly move across sectors.
- Land moves within agricultural sectors; natural resource is specific to the resource using sector.
- Labour and capital move imperfectly across sectors in response to the differences in factor returns.
- Inter-sectoral factor movement is controlled by overall return maximizing behaviour subject to a Constant Elasticity of Transformation (CET) function.[59]

DAE-RGEM is based on a substantial body of accepted microeconomic theory. Key features of the model are:

- The model contains a 'regional household' that receives all income from factor ownerships (labour, capital, land and natural resources), tax revenues and net income from foreign asset

[59] By raising the size of the elasticity of transformation to a large number we can mimic the perfect mobility of a factor across sectors and by setting the number close to zero we can make the factor sector specific. This formulation allows the model to acknowledge the sector specificity of part of the capital stock used by each sector and also the sector specific skills acquired by labour while remaining in the industry for a long time. Any movement of such labour to another sector will mean a reduction in the efficiency of labour as a part of the skills embodied will not be used in the new industry of employment.

holdings. In other words, the regional household receives the gross national income (GNI) as its income.

- The regional household allocates its income across private consumption, government consumption and savings so as to maximise a Cobb-Douglas utility function. This optimisation process determines national savings, private and government consumption expenditure levels.
- Given the budget levels, household demand for a source-generic composite goods is determined by minimising a CDE (Constant Differences of Elasticities) expenditure function. For most regions, households can source consumption goods only from domestic and foreign sources. In the Australian regions, however, households can also source goods from interstate. In all cases, the choice of sources of each commodity is determined by minimising the cost using a CRESH (Constant Ratios of Elasticities Substitution, Homothetic) utility function defined over the sources of the commodity (using the Armington assumption).
- Government demand for source-generic composite goods, and goods from different sources (domestic, imported and interstate), is determined by maximising utility via Cobb-Douglas utility functions in two stages.
- All savings generated in each region are used to purchase bonds from the global market whose price movements reflect movements in the price of creating capital across all regions.
- Financial investments across the world follow higher rates of return with some allowance for country specific risk differences, captured by the differences in rates of return in the base year data. A conceptual global financial market (or a global bank) facilitates the sale of the bond and finance investments in all countries/regions. The global saving-investment market is cleared by a flexible interest rate.
- Once the aggregate investment level is determined in each region, the demand for the capital good is met by a dedicated regional capital goods sector that constructs capital goods by combining intermediate inputs in fixed proportions, and minimises costs by choosing between domestic, imported and interstate sources for these intermediate inputs subject to a CRESH aggregation function.
- Producers supply goods by combining aggregate intermediate inputs and primary factors in fixed proportions (the Leontief assumption). Source-generic composite intermediate inputs are also combined in fixed proportions (or with a very small elasticity of substitution under a CES function), whereas individual primary factors are chosen to minimise the total primary factor input costs subject to a CES (Constant Elasticity of Substitution) aggregating function.

D.2. Economic impact sensitivity analysis

This section outlines key sensitivity results from the economic impact modelling undertaken in Sections 5 and 6. Here sensitivities are performed testing how the economic impact modelling results are affected by differing scales of processing output. As outlined in Table D.2 a range of processing scales are considered with the main body of the report describing the high scenario where 170 million kilograms is processed. This section outlines the effect on the results where smaller volumes are processed including throughput volumes of 42.5 million kg (low) and 85 million kilograms (medium).

Table D.2: Summary of key policy scenario parameters

	Units	Low	Medium	High
Greasy wool throughput	million kg (annual peak)	42.5	85.0	170.0
Wet processing				
Capital investment	$ million (total, undiscounted)	142	284	567
Direct jobs	FTE jobs (annual peak)	158	315	631
Early-stage processing				
Capital investment	$ million (total, undiscounted)	280	560	1,119
Direct jobs	FTE jobs (annual peak)	323	647	1,293

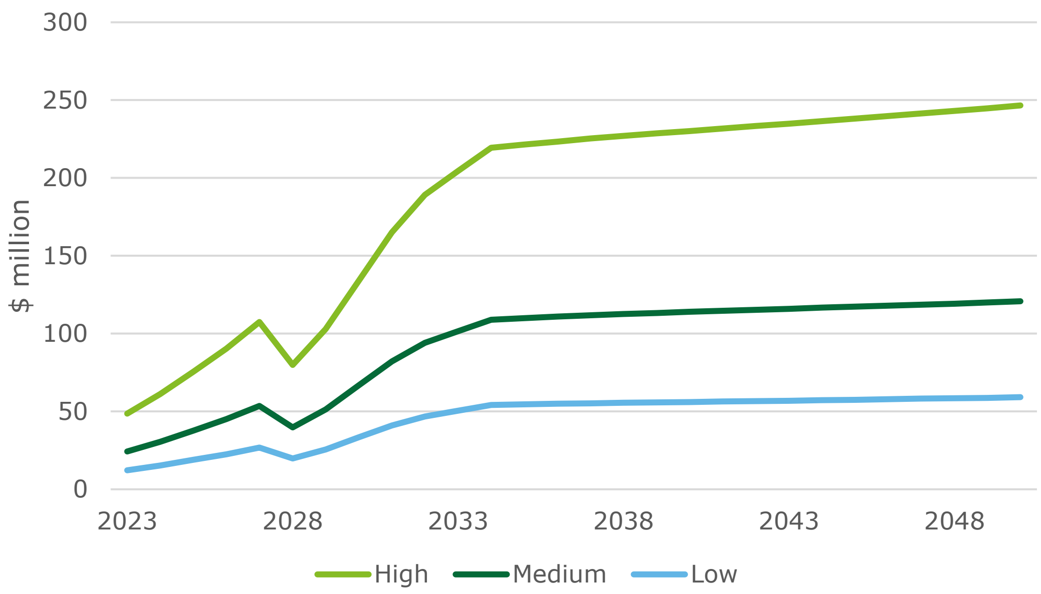
Source: Deloitte Access Economics (2022).

Note: Capital investment excludes land purchases.

The results of the sensitivity analysis are outlined in Chart D.1 to Chart D.4, describing impacts to economic activity and employment. The total impact to the economy varies in line with the scale of output and the specific set of activities undertaken.

Were 85 million kg to be fully processed (including both wet and dry activities) for example, the present value of impacts is estimated at $0.9 billion (discounted at 7%) between 2023 and 2050, around half that for the high scenario where 170 million kilograms are assumed to be processed and the present value impact to GDP totals $1.9 billion over the same period. This compares with present value impacts of $0.5 billion for the low scenario where an additional 42.5 million kilograms are assumed to be processed (Chart D.1).

Chart D.1: Impact to GDP selected levels of processing throughput, wet and dry processing

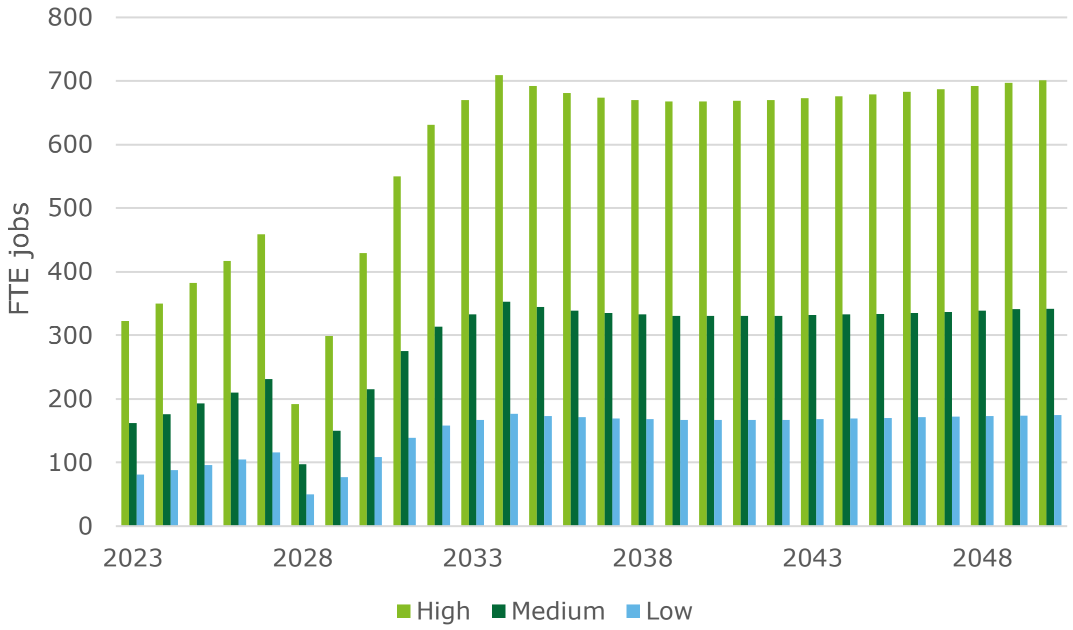


Source: DAE-RGEM (2022).

As with the impact to GDP, employment impacts vary in line with the level of throughput increase in Australia. Chart D.2 shows that for the medium scenario with full early-stage processing, the average impact to employment at 289 Full Time Equivalent (FTE) jobs is around half that for the high scenario. Similarly, were a smaller increase in wool processing undertaken the low scenario shows that the impact to employment would again be smaller at around 146 FTE jobs on average.

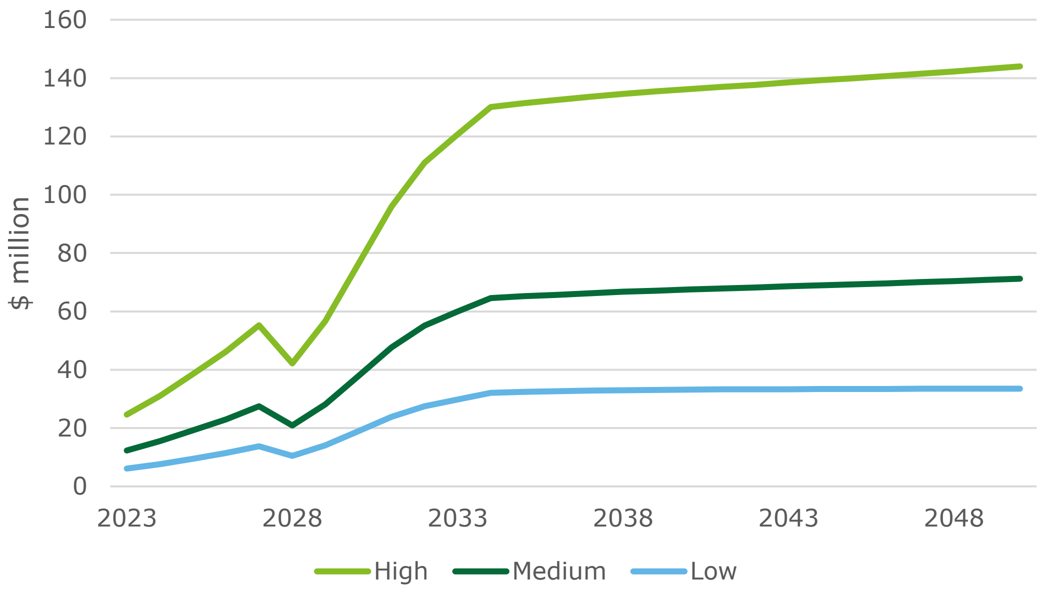
Results for the wet processing only scenario are described in Chart D.3 (impact to GDP) and Chart D.4 (impact to employment).

Chart D.2: Impact to employment, selected levels of processing throughput



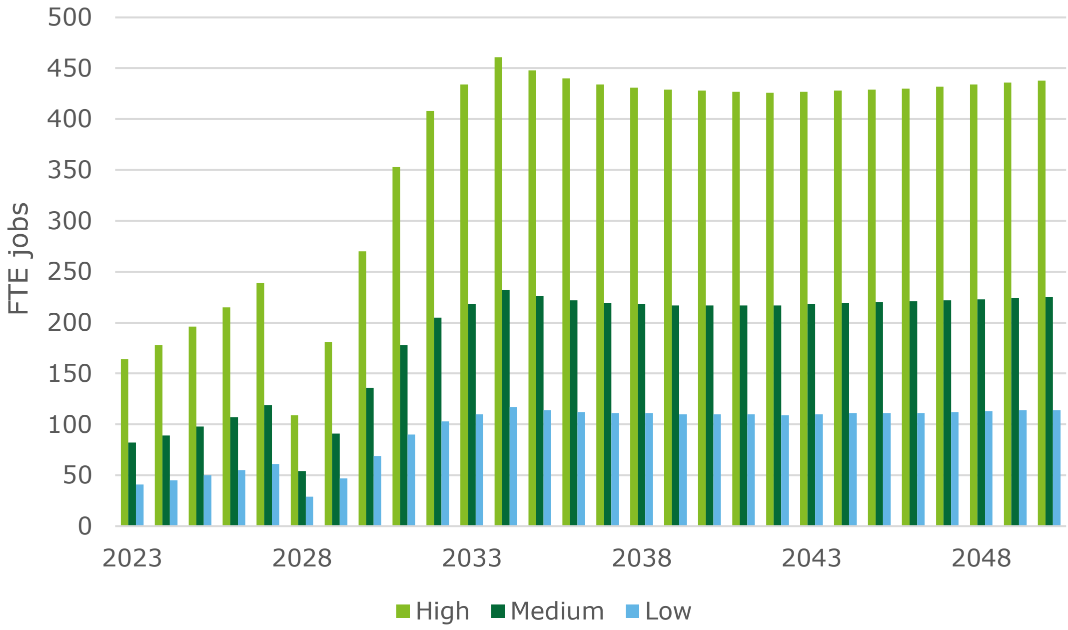
Source: DAE-RGEM (2022).

Chart D.3: Impact to GDP selected levels of processing throughput, wet processing



Source: DAE-RGEM (2022).

Chart D.4: Impact to employment selected levels of processing throughput, wet processing



Source: DAE-RGEM (2022).

Endnotes

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